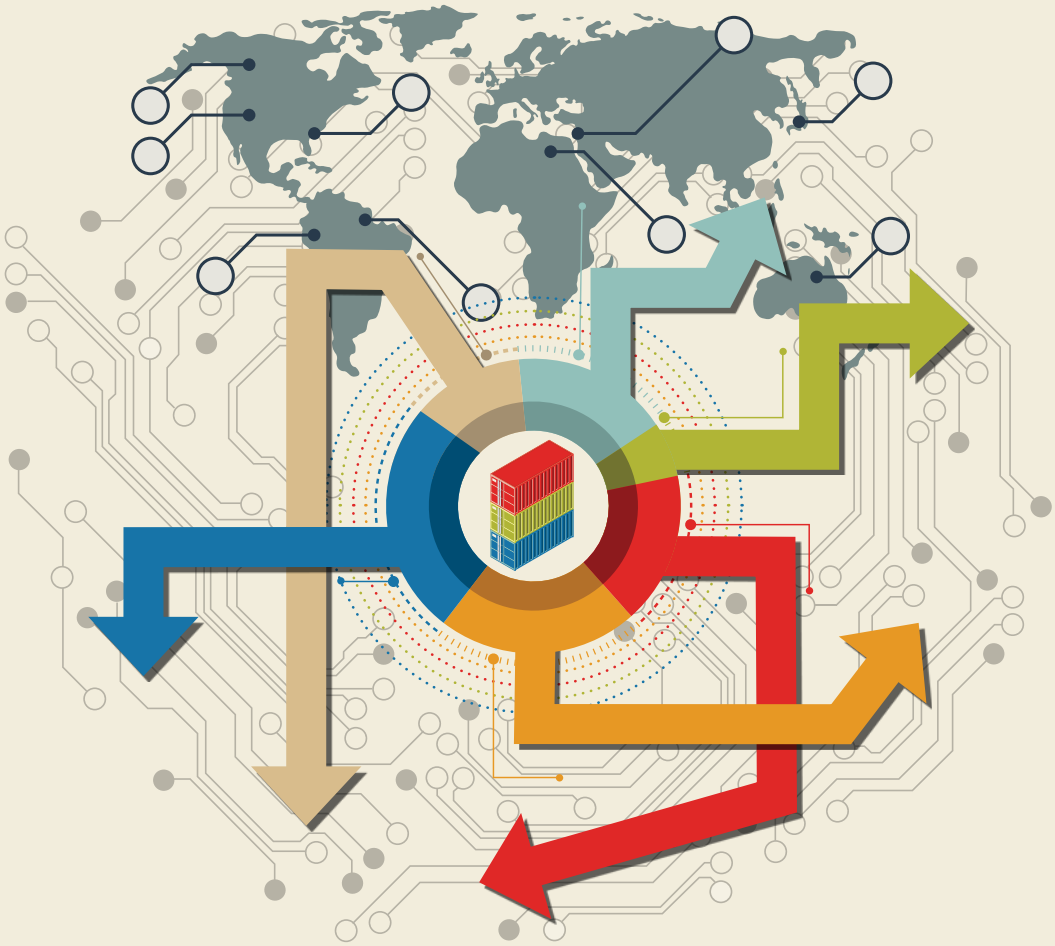
9th ANNUAL STATE OF LOGISTICS™ SURVEY FOR SOUTH AFRICA 2012

Connecting Neighbours - Engaging the World



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ISBN number: 978-0-7988-5609-6

Design and layout by Designwave, www.designwave.co.za

EXECUTIVE SUMMARY

Nadia Viljoen (CSIR),
Scientific editor: 9th State of Logistics™ survey

While growth prospects in the developed world are meagre at best, big business turns its attention to developing regions such as southern Africa for its next growth frontier. Multinational corporations, unlike governments, do not see political boundaries when they consider a region, they regard the growth of consumer populations, the development of economies, the discovery of raw materials, the availability of labour and – of relevance to this survey – the ease with which products and services can be moved into, out of and within that region. This 'business mobility' stretches further than the physical rail lines and highways between countries; it includes the openness of governments to collaborate with one another and with the private sector; the removal of regulatory and operational barriers in cross-border trade; the availability of logistics services that penetrate the entire region, not just one country; and, critically, the availability of appropriately skilled people who are the lifeblood of a vibrant logistics sector.

Although Africa's current participation in global trade is negligible – less than 5% – , governments and businesses agree unanimously that the potential of the continent, southern Africa in particular, is palpable. This sentiment is evidenced by the increase in foreign direct investment in sub-Saharan Africa from US $29 billion in 2010 to US $37 billion in 2011[1]. However, southern Africa still has many bridges to build before it represents a coherent region of economic potential to investors. Intra-African trade is estimated at only 10%, while regional trade in the developing markets of South America and Asia is 22% and 50%, respectively[2].

The 9th State of Logistics™ survey for South Africa 2012 delivers a message of action. South Africa must make great strides in addressing critical issues relating to the road freight sector, shifting freight from road to rail and addressing rampant skills shortages and misalignment in the logistics sector. The Southern African Development Community (SADC) needs to see governments and the private sector joining hands to realise ambitious inland corridor initiatives and develop a world-class maritime transhipment community that would open the region up for trade. Globally, the scales are tipping that measure the trade-offs favouring economic specialisation, economies of scale and growth in international trade at the cost of a higher demand for freight transport. A reframing of the role of logistics in supporting truly sustainable economic development is imminent.

1 Albert, A. and Jali, P. *Accessing Africa: What gate, which way?* eThekwini Municipality. Economic Development and Investment Promotion Unit: Policy, Strategy, Information & Research.

2 Hasse, K. *Non-tariff barriers choke African trade.* Good Governance Africa. Available: http://gga.org/analysis/non-tariff-barriers-choke-african-trade

SECTION 1: LOGISTICS COSTS

National logistics costs and global trends

This year's survey takes a huge leap in the study and publication of South Africa's national logistics costs which is in its ninth consecutive year. Dedicated effort from researchers to close the time-lag between data collection and publication has ensured that the 2013 edition reports on logistics costs and freight flows of both 2011 and 2012. Furthermore, the calculation of the four components of logistics costs (transport costs, inventory carrying costs, warehousing and management and administration) is now on par with international benchmarks through on-going collaboration with a growing number of global experts in the field. The calculation of externality costs in this year's survey has also been greatly refined. The focus of the study has been to dig deeper into the underlying logistics behaviour that drives cost trends and to scrutinise the relationship between logistics costs and the GDP.

Logistics costs as a percentage of total GDP have risen by 0.7% to 12.6% in 2011 and are estimated to have risen to 12.8% in 2012. A starker reality is painted, however, when considering logistics costs as a percentage of only the primary (extraction) and secondary (beneficiation) sectors. Logistics costs as a percentage of the transportable GDP was 44% in 2011 and 46% in 2012. The upward trend of transport costs was identified as a major risk in previous surveys. Its contribution to overall logistics costs in 2012 is pinned at 61%, the highest it has been in the past nine years and far higher than the global average. The vulnerability of transport costs to a volatile exogenous cost driver – the price of crude oil – and South Africa's entrenched dependence on road transport does not bode well for the economy if the future is to be business-as-usual.

Inland freight volumes have risen across the board in 2011 (+4.9% in tonnes, +10.1% in tonne-km) and 2012 (+1.8% in tonnes, +2.1% in tonne-km) with the most significant growth being on the KwaZulu-Natal–Gauteng and Western Cape–Gauteng corridors. Worth noting is the slight increase in overall rail market share, from 11.1% in 2010 to 11.5% in 2012 in terms of tonnes, and from 29.3% in 2010 to 29.9% in 2012 in terms of tonne-km.

Globally the opinion is growing that economic specialisation, economies of scale and the resulting global trade have reached their peak and decades to come will see a revolution in how economic growth will be characterised. These drastic changes in trade will force a re-evaluation of the role of logistics, requiring innovative supply-side solutions to drive efficiency and radical demand-side solutions to reduce the demand for logistics services. GDP will no longer be the trumping development metric.

Investigation of road freight challenges and costs in South Africa

With 70.1% of South Africa's inland tonne-km on road, challenges and cost escalations in the road freight sector affect all South Africans – businesses and consumers alike. Data gathered from a broad range of industry and government stakeholders identified the key challenges and cost drivers in the South African road freight sector. Respondents felt that poor road conditions (64%), the cost of fuel (52%) and a lack of law enforcement and prevalent non-compliance (43%) are the top three challenges in the industry. The condition of the country's roads is also regarded as a critical cost driver by 73% of the respondents, followed by the (un)availability of return loads and the costs associated with empty runs (66%), congestion and its associated delays (52%), and theft (52%).

Compared to the United States of America (USA), the United Kingdom (UK) and Australia, South Africa has the lowest per-lane construction cost at R30 million/lane-km and the lowest per-lane maintenance cost at R300 000/lane-km. Lower labour costs in South Africa and the fact that South Africa conducts significantly less maintenance on its road network contribute to these figures. South Africa does, however, have the highest percentage of road transport costs to GDP (4.7%) which is not surprising if one considers the relatively low investment in maintenance and the cited contribution of poor road conditions to road freight costs.

Basically, key challenges experienced by stakeholders in the sector are problems linked to the country's road infrastructure and government service delivery, as well as a lack of policies and the implementation of these.

The potential effects of deteriorating road conditions in South Africa

The contrast between the state of South Africa's primary road network, managed and maintained by the South African National Road Agency Limited (SANRAL), and its secondary network, provincial road networks managed and maintained by provincial authorities, is blatant in this year's analysis. If the 2011 road freight volumes on the 22 major freight corridors were transported on provincial roads instead of the primary road network, there would have been an increase of R625 million in fuel, tyre and maintenance and repair costs impacting operators directly. While SANRAL has done a good job of maintaining the primary road network, the condition of provincial road networks has deteriorated markedly.

The contribution of poor road conditions to fatal accidents shows, however, that the effect of bad roads stretch much further than increased vehicle operating costs. Road-related factors contribute to 5-15% of fatal road accidents, of which 28% can be attributed to poor road surface conditions. The total cost of fatal accidents caused by poor road conditions in 2010/2011 is estimated at between R207 million and R621 million. Hundreds of deaths could have been prevented if roads were kept in acceptable conditions.

SECTION 2: REGIONAL CONNECTIVITY

Developing the SADC port community

There lies great opportunity for SADC in becoming a world-class transhipment community. Firstly, the benefits to inland supply chains will be immense as frequent and reliable coastal shipping and better connectivity to global markets propel operational efficiencies. Secondly, SADC could earn tangible revenues by offering transhipment services for maritime traffic currently passing by the continent on the Cape Route, not to mention the volumes of transhipment cargo that could shift from the Suez Canal Route to the Cape Route if SADC offered a globally competitive transhipment alternative.

Compared to three other established transhipment communities, namely South East Asia, the Caribbean and the Mediterranean, SADC has much ground to cover in terms of establishing intraregional connectivity and boosting its importance in the context of the global maritime network. South Africa and Mauritius currently rank 39th and 50th, respectively, out of 157 coastal countries in terms of maritime importance.

The comparison also shows that SADC is similar to the Mediterranean in that the economies that play the most influential role in the port community structure are also home to the port authorities. This contrasts with the South East Asian and Caribbean communities that hinge on economies outside of the communities. Port authorities in SADC thus have a decisive influence in driving the vision of a world-class transhipment community. This vision requires port authorities to become facilitators that bring together those private and public sector role players without which any SADC maritime strategy is but wishful thinking.

In terms of developing a thriving port community, the key competitive elements that require specific attention in SADC are the regional connectivity of its inland transport,

the quality of inland logistics services, cargo availability and good market structure. Further competitive differentiators that could enhance SADC's standing in the maritime community are lowering port tariffs, especially for transhipment cargoes; enhancing the availability of ship services at ports; and increasing the reliability of port operations and scheduling. All these competitive differentiators are, however, moot points if infrastructure constraints and operational capacity simply cannot handle increased business volumes or larger vessels.

Inland connectivity in SADC

Immense potential and business opportunities exist in southern Africa in terms of natural resources, low-cost labour and a rapidly growing consumer market. Three quarters of business executives in South Africa have indicated that expanding into emerging markets is one of their top five strategic objectives, with SADC being the most favoured destination. However, the top three constraints to doing business in Africa are: Availability of reliable service providers and partners; lack of adequate infrastructure; and transit times and reliability[3]. The region aims to redress a legacy of extremely poor inland connectivity through the development of strategic trade and logistics corridors that link economic centres, countries and ports.

Various corridor initiatives are underway in SADC, some more advanced than others. Corridors serving developed cargo bases are the Trans-Caprivi, Trans-Cunene and Trans-Kalahari corridors stretching inland from Walvis Bay and the Maputo corridor, linking Mozambique with South Africa. Corridors running south from Dar es Salaam are earmarked as high-growth corridors while the Nacala, Beira, Mtwara and Lobito corridors will become high-growth corridors in the long-term in response to the rapid development of mining activities in SADC.

For the corridor initiatives to be successful, governments need to create an environment conducive to lucrative public-private partnerships. The necessary collaborative platforms and frameworks required to fast-track open discussion and negotiation between public and private sectors are lacking and this must be redressed urgently. More generally, the integrity and strength of political and regulatory institutions are still questionable in SADC and corruption erodes competitiveness and broad-based socio-economic development.

Additional operational barriers that must be addressed are the cargo imbalances that result in millions wasted on empty trips, and gross cross-border inefficiencies that increase transit time and diminish reliability.

3 Barloworld Logistics. 2012. *2012* supply*chain*foresight*: South Africa Inc.: Growth, Competitiveness and the Africa Question*. Available: www.supplychainforesight.co.za.

SECTION 3: TOPICAL RESEARCH

Transport infrastructure and planning

Infrastructure – transport infrastructure in particular – is critical for the economic development and growth of a country. The National Development Plan, now adopted by the South African government as its development plan for the future, clearly states the tremendous challenge the country faces in this regard by effectively missing a generation of capital investment in infrastructure. South Africa is not unique; around the world, inadequate or poorly maintained infrastructure presents major economic challenges, competing for scarce resources from governments already struggling financially.

The latest report card published by the South African Institution of Civil Engineering (SAICE) describes the state of freight transport infrastructure in the country. It highlights the severe disparity in road conditions depending on the government authority responsible for its upkeep. On the rail side, heavy-haul freight lines are well maintained and general freight lines show a slight improvement, while branch networks are in a state of disrepair. Ports show steady improvement and are reported to be fairly well-maintained. The Airports Company of South Africa (ACSA) provides world-class aviation infrastructure at most of the airports under its jurisdiction.

South Africa has a legacy of good, comprehensive transport infrastructure plans that do not get implemented. The Moving South Africa Forward Strategy developed in 1998 was succeeded by the National Freight Logistics Strategy in 2005 and then the National Transport Master Plan 2050 (NATMAP 2050). The first two plans had limited impact while it is too early to judge the results of NATMAP 2050.

Renewed emphasis by government in 2012 on infrastructure development resulted in the establishment of the Presidential Infrastructure Coordinating Commission (PICC), headed by the President, to coordinate and oversee the implementation of strategic infrastructure projects (SIPs) that stimulate social and economic growth. Public-sector funding for all infrastructure projects is estimated at R844.5 billion for the 2012/2013–2014/2015 period, with Transnet to invest a further R300 billion in rail and port developments over seven years starting in 2012. However, private-sector involvement is non-negotiable for the success of transport infrastructure projects – both from a funding and planning point of view.

Skills shortages and requirements in the logistics industry in South Africa

The unavailability of a skilled workforce is viewed as one of the key constraints to the expansion of business operations in South Africa. This appears to be a global problem with 39% of businesses around the world struggling to recruit the appropriate people. Nearly two in five businesses (37%) in the BRIC (Brazil, Russia, India and China) economies believe an inability to get the right workers will dampen growth in 2013. It has thus become critical to identify the logistics skills requirements in South Africa so that these acute shortages can be addressed to the benefit of trade in and with South Africa and SADC.

Two surveys were conducted in 2011 and 2012 to ascertain the trends and statistics with regard to the current logistics skills gaps in South Africa. The six primary skills groups emanating from the surveys were: *General management*; *Behavioural/Interpersonal skills*; *Logistics awareness*; *Logistics analytical*; *Logistics information technology (IT)*; and *Environmental awareness*. In both years *Logistics awareness* was rated as the most important skills group, followed closely by *General management*. In 2012, *Logistics analytical* skills moved from fourth to third position. Managers also indicated that those skills regarded as most critical when recruiting people in the logistics sector comprise the 'softer' skills that fall under *Behavioural/Interpersonal skills*, *General management* and *Logistics awareness*.

On operational level, South African businesses generally expect at least a high school education, if not more. At tactical level, businesses generally expect some form of tertiary education and at strategic level, this increases to a general minimum of a Bachelor's degree. Similar patterns are indicated regarding experience; it is generally expected that some level of experience is required, even at operational level. This increases at tactical level and even more at strategic level, where the majority of businesses require at least five years of experience.

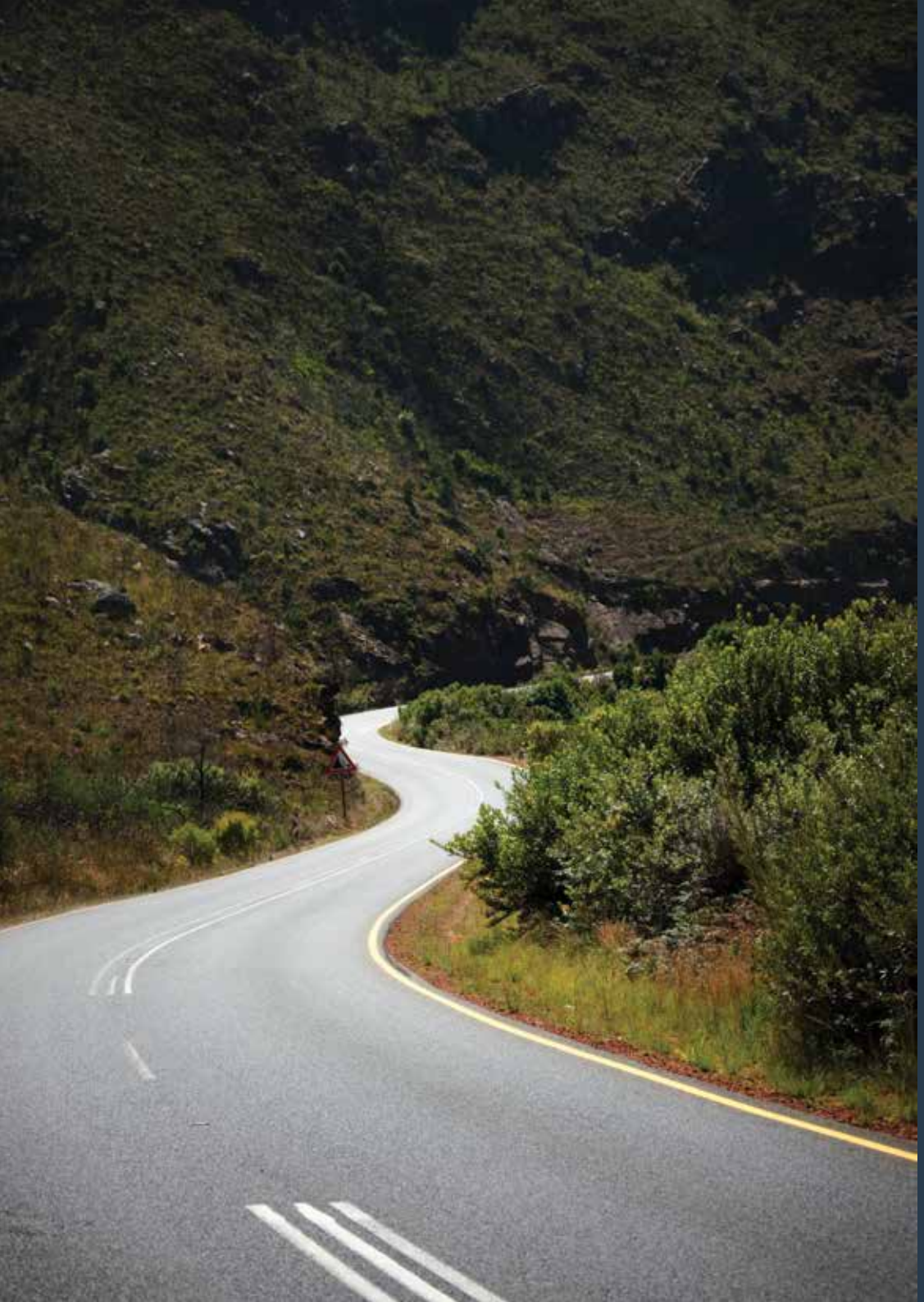
Although operational positions are relatively easy to fill, an average of 65% of South African employers in the logistics sector have indicated that it was difficult to fill tactical-level positions. Strategic-level positions are becoming more challenging to fill, with 63% indicating difficulties in 2011 and 66% in 2012.

CONCLUSION

The 9th State of Logistics™ survey covers a broad range of research topics contributed by a variety of experts in the field. This executive summary is aimed at whetting your appetite for interacting with the articles contained in the publication. This year's edition marks a milestone in the journey of the survey. Much effort went into preparing logistics costs and freight flow results for 2011 and 2012, effectively closing the two-year time lag in previous reporting. In addition, the research process was opened to industry feedback through a pre-launch event which provided valuable input during the compilation of the articles.

ACKNOWLEDGEMENTS

The CSIR is proud to present the 9th State of Logistics™ survey in concert with IMPERIAL Logistics and the Stellenbosch University Centre for Supply Chain Management. Furthermore, this publication would not have been possible without the research contributions by the University of Pretoria, the University of Johannesburg, Volition, Taemané Blue, the Department of Transport and HWI Consulting.



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SECTION 1:
LOGISTICS COSTS

NATIONAL LOGISTICS COSTS AND GLOBAL TRENDS

Havenga, Jan and Simpson, Zane
(Stellenbosch University)

THE GLOBAL STATE OF LOGISTICS COST SURVEYS

The study and publication of South Africa's logistics costs is in its ninth consecutive year, allowing for time series analysis, trend investigation and model refinement based on user feedback. The insights and perspectives from this on-going research have been pivotal in informing macro-economic policy, transport infrastructure planning and strategic collaboration in the freight sector. The goal of these plans being to improve the efficiency of the national logistics systems, an objective measured by a single metric – logistics cost as a percentage of Gross Domestic Product (GDP). The objectives of this year's study were to dig deeper into the logistics behaviour that drives cost trends in South Africa and to scrutinise the relationship between GDP and logistics costs, with the aim of refining the requirements for future measurements in South Africa and contributing to the work of a global group of peers dedicated to this work.

The global interest in measuring and tracking logistics costs on an annual basis has increased dramatically over the past decade. The growing group of specialists acknowledges the difficulties in successfully measuring macro-level logistics costs nationally; consequently there is a strong drive to collaborate, resulting in a body of knowledge that is forming global comparable methodologies. South Africa is one of only three countries, along with the United States of America (USA) and Finland, that has conducted consistent annual surveys over the past five years. Since 2006, more than 10

countries set out to measure logistics costs every year, although none of these have been successful in consistent annual measurements. Recent meta-analysis[4] has established that since 1995, 14 countries have attempted a survey-based measurement and 11 countries a statistics-based measurement. Overall, the number of consecutive national surveys is growing, which will allow more robust time series analysis of logistics cost trends in the near future.

The Logistics Performance Index Observatory (LPIO), a recent initiative driven by the World Bank, has been convening global meetings since June 2010 to compare the results and methodologies for measuring macro-level logistics costs. South African researchers have been contributing to these meetings since their inception. At the most recent meetings held in Finland and Washington in 2012, the contributions made by researchers from Finland, Canada, Brazil, Germany, France, Korea and South Africa and especially those contributions by Jean-Francois Arvis and Laurie Ojala, co-authors of the Global Logistics Performance Index[5], made great progress in pinning down standardised methodologies for measurements. Following these discussions, certain methodological improvements were made to the calculation of South African logistics costs and all historical data were concordantly adjusted to reflect these changes. These improvements reflect logistics costs more accurately and make the figures more comparable with international benchmarks.

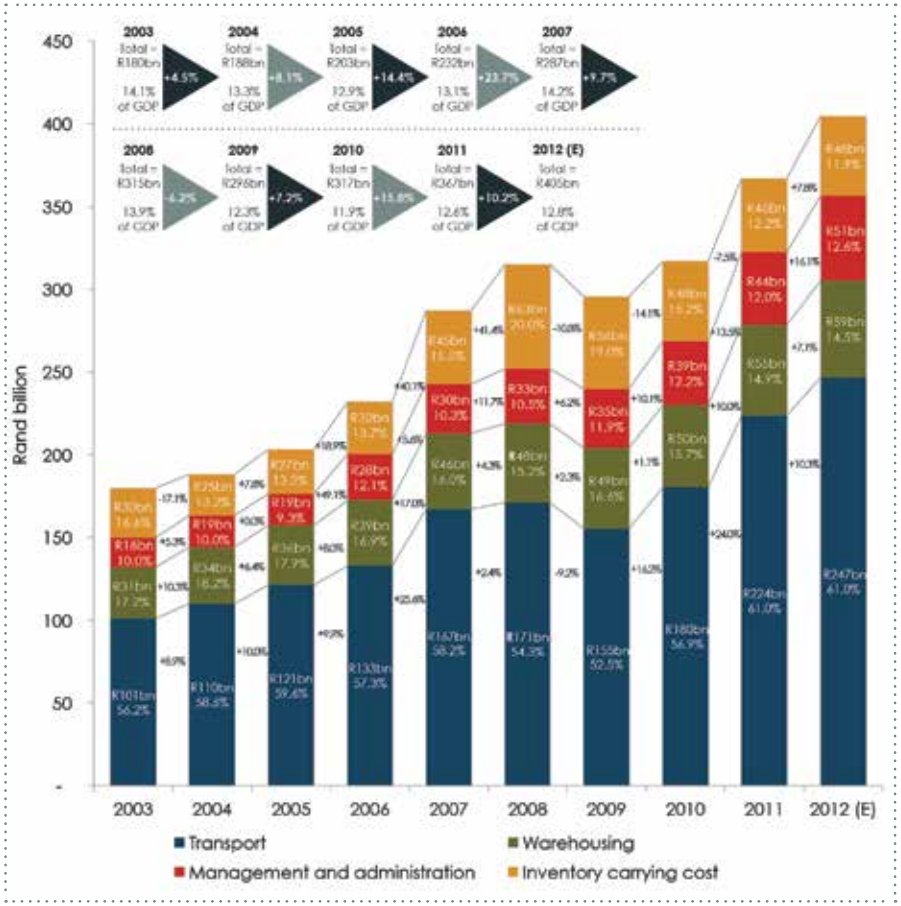
SOUTH AFRICAN LOGISTICS COSTS

A major difficulty in the annual statistics-based calculation of logistics costs is the considerable lag in obtaining data from various sources and the time required to collate these data. It is for this reason that previous editions of the State of Logistics™ survey for South Africa reported logistics cost data with a two-year time lag. In 2013, for the first time, the researchers have succeeded in closing the gap. By taking into account the known values of certain inputs such as the fuel price, interest rate and GDP during 2012, and the estimated freight flow inputs based on 2011 data, estimated logistics costs for 2012 could be calculated.

The two most notable methodological changes reflected in this year's study was removing *profit* as a cost element from the *Management and administration* cost component and adapting the calculation of *Storage and ports* and renaming the cost component *Warehousing*. The calculation of these cost components now more accurately reflects the international benchmark.

Figure 1 tracks logistics costs over the past nine years. Logistics costs as a percentage of total GDP have risen by 0.7% to 12.6% in 2011 and are estimated to have risen slightly to 12.8% in 2012. **Figure 2** shows the downward trend in logistics costs as a percentage of total GDP over the past nine years.

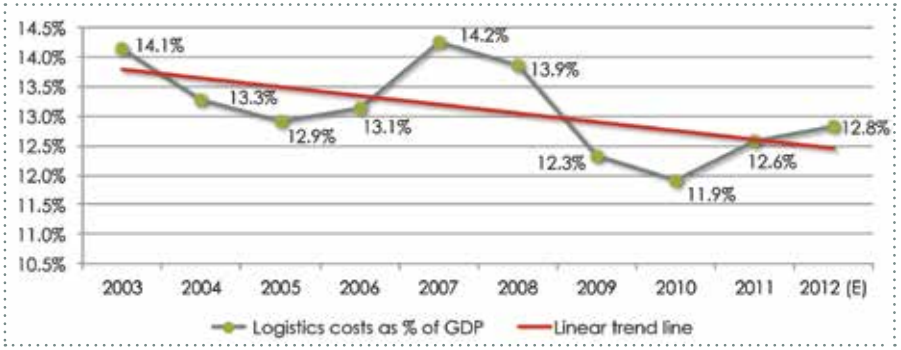
Figure 1: South Africa's logistics cost components and GDP comparison



4 Rantasila, K. and Ojala L. 2012. *Measurement of National-Level Logistics Costs and Performance: Discussion Paper 2012-04*. Paris: International Transport Forum at the OECD.

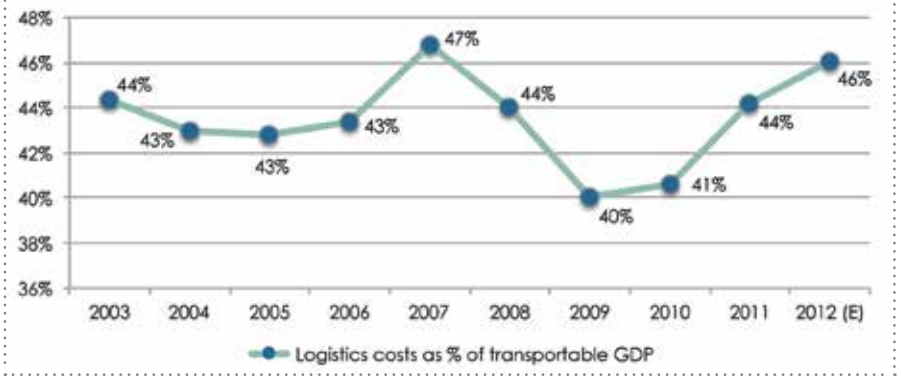
5 Arvis, JF., Mustra, MA., Ojala, L., Shepherd, B., and Saslavsky, D. 2012. *Connecting to Compete: Trade Logistics in the Global Economy: The Logistics Performance Index and Its Indicators*. The World Bank. Washington, D.C.

Figure 2: South Africa's logistics costs relative to GDP



Although the recent downward trend could be reassuring, it does not paint a representative picture. The total GDP comprises the primary (extraction), secondary (beneficiation) and tertiary (services) sectors. The primary and secondary sectors are considered 'transportable' as these involve the movement of raw materials and manufactured goods. The tertiary sector does not generate significant demand for logistics services. When considering logistics costs as a percentage of only the transportable GDP (**Figure 3**), the situation is dire, approaching 50%.

Figure 3: Logistics costs as % of transportable GDP



The contribution of the four cost components to the total logistics costs (**Figure 1**) is depicted comparatively in **Figure 4** and the deflated cost components per tonne in **Figure 5**. The disproportionate contribution and dramatic increase in transport costs are alarming. Transport costs shot up by 24% between 2010 and 2011, and a further increase of 10.3% is estimated between 2011 and 2012 (**Figure 1**). This pins the contribution of transport costs to overall logistics costs at 61%, which is its highest level since the survey's inception and also significantly higher than global averages. This increase in transport costs was identified and predicted as a major risk in previous years' surveys.

Figure 4: Contribution of logistics cost components to total logistics costs

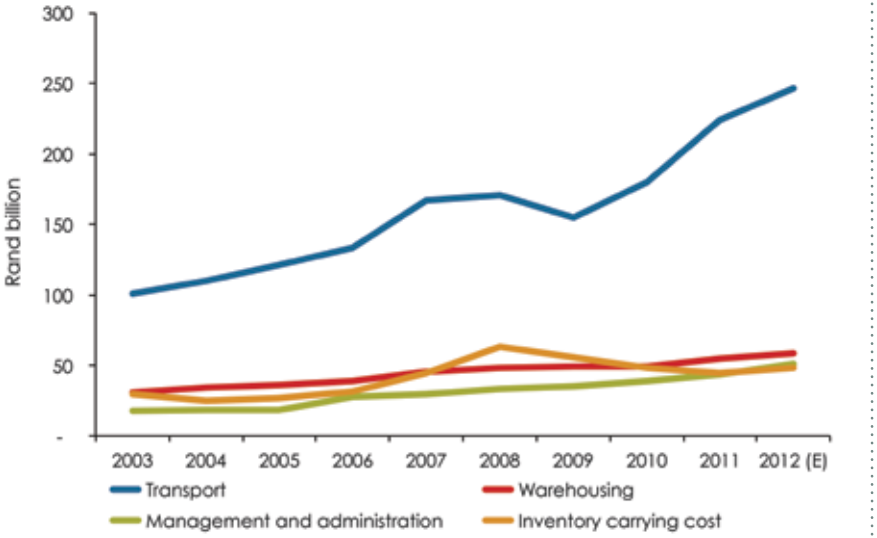
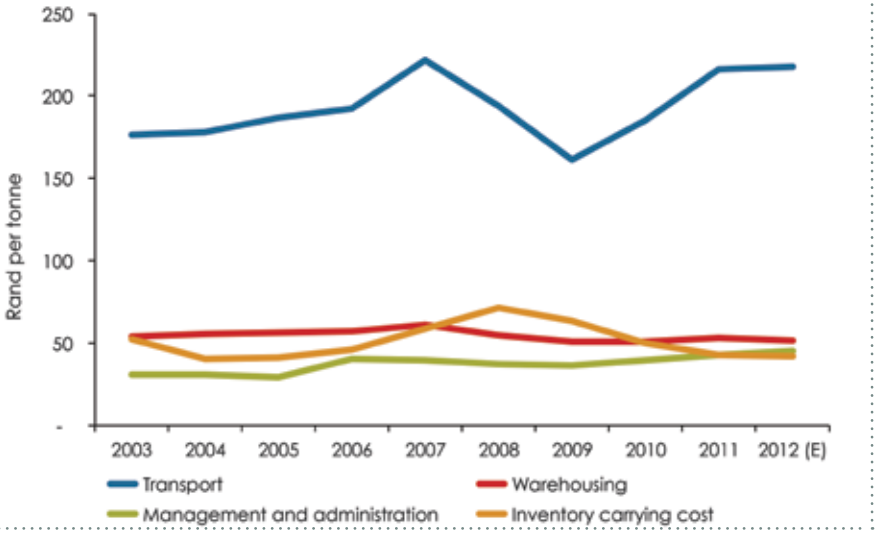
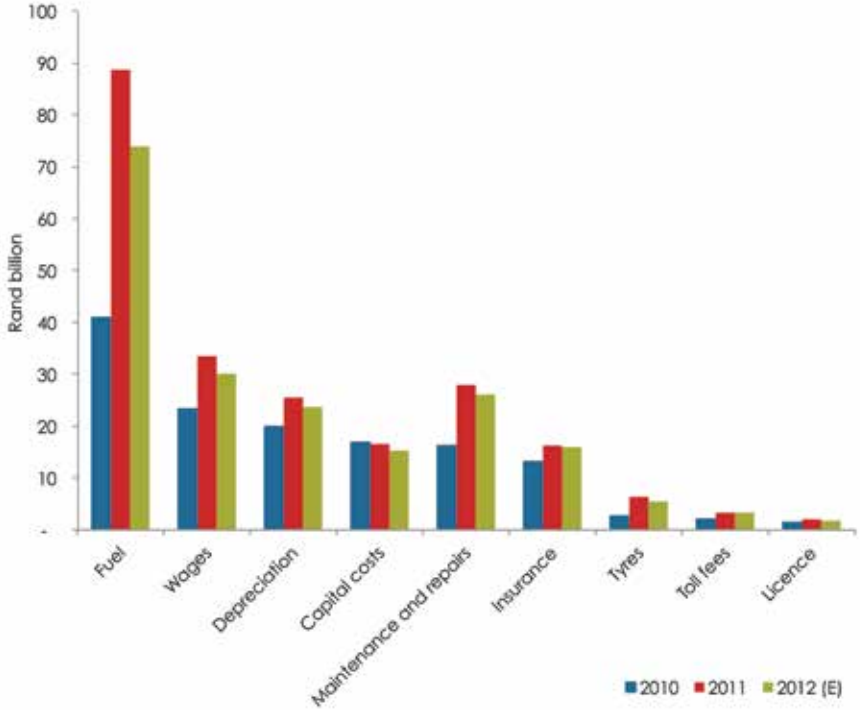


Figure 5: Deflated contribution of logistics cost components to total logistics costs (Rand per tonne)



A closer look at the road transport cost elements (**Figure 6**) indicates the gravity of fuel's contribution to transport costs, being more than double the second highest cost element, namely wages. *Investigation of road freight challenges and costs in South Africa* (pp 20-28) presents a more in-depth look at road freight challenges and costs.

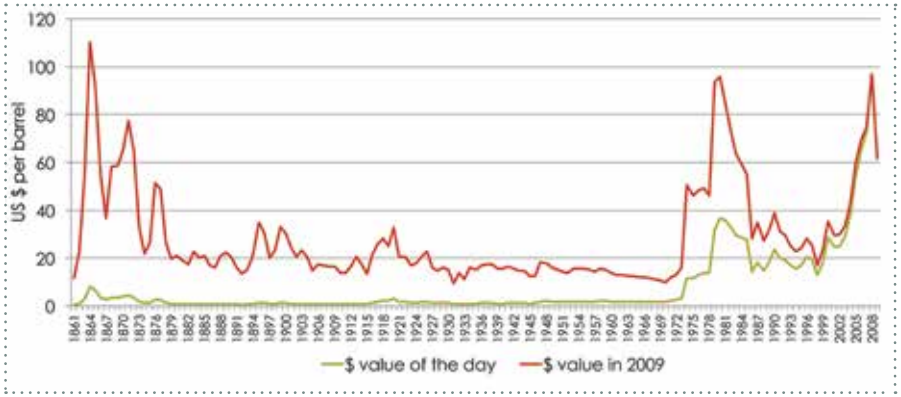
Figure 6: Road transport cost components



Apart from transport costs, the other most volatile component is inventory carrying cost. These two components are primarily driven by the respective exogenous cost drivers, the diesel price and the prime interest rate (**Figure 7**). The prime interest rate came down over the years, with a weighted average of 9.92% during 2010, 9% during 2011 and 8.75% during 2012. While this interest rate has been decreasing, inventory levels have risen by just over 10% in 2012, resulting in a rise in inventory costs of just below 8% between 2011 and 2012. The prime interest rate is expected to rise again as economies recover, but as a cost driver it does not pose as much risk as the diesel price, which is exposed to the volatility of the underlying natural resource, crude oil (**Figure 8**).

Figure 7: Trends in South Africa's prime interest rate and diesel price

Figure 8: Historic crude oil prices since 1861 (WTRG Economics[6])



Provincial logistics costs

The 8th State of Logistics™ survey for 2011 reported logistics costs on a provincial level for the first time. This year's update (**Figure 9**) shows that logistics costs have increased in most provinces, although the relative positions of the provinces to the respective GDPs remained rather similar. The exception is the Northern Cape, which indicated a significant improvement in its logistics costs as a percentage of GDP between 2010 and 2011, even though it still has the highest ratio of all the provinces. A breakdown of the cost components per province is given in **Figure 10**.

6 Williams, JL. 2013. *Analysis, planning, forecast and data services for energy producers and consumers.* London: WTRG Economics.

Figure 9: Logistics costs per province for 2010 and 2011

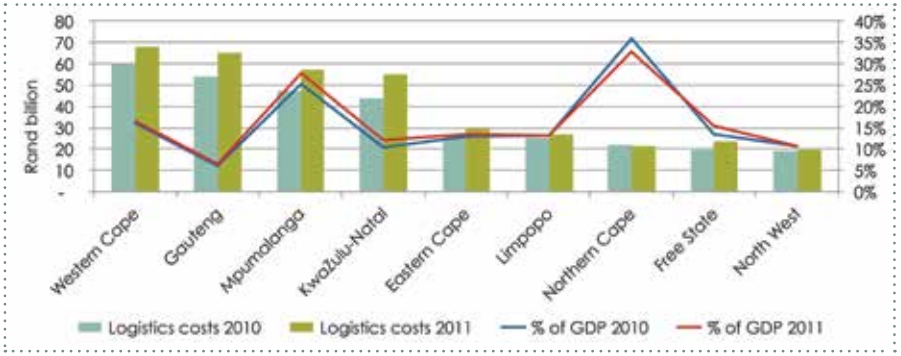
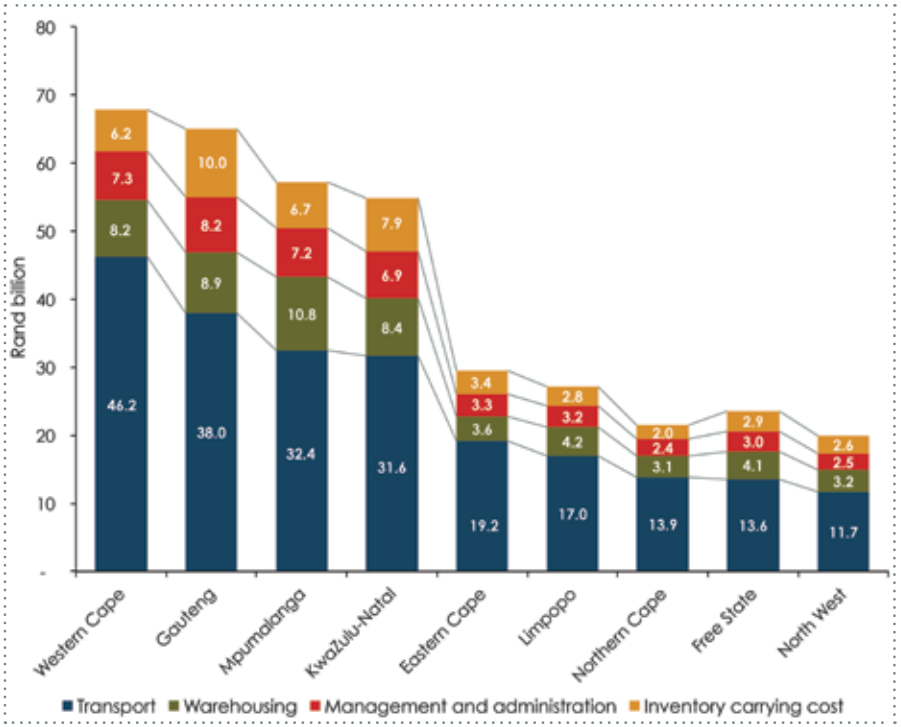


Figure 10: Logistics costs per province broken down into cost components for 2011

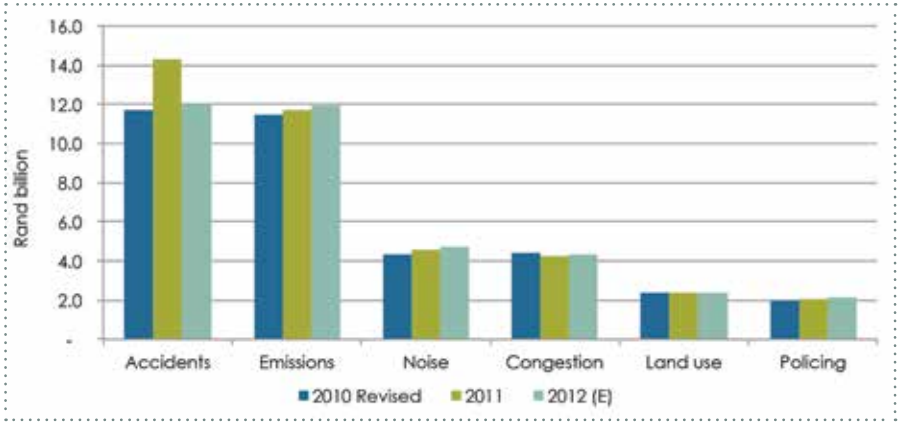


Externality costs

The quantification of externality costs is a frequent topic of debate worldwide. In previous surveys, although the South African externality costs were based on South African input values, certain costs such as the value of human life and carbon offset costs had to be substituted with global averages. These costs have now been determined for South Africa specifically[7,8]. The 2011 externality costs and estimation of 2012 externality costs were calculated using these more representative values (**Figure 11**). The 2010 externality costs have also been revised (**Table 1**).

For the first time, land-use costs have been included as an externality cost. It is defined as the opportunity cost of having a road or railway occupying a piece of land instead of some other revenue-generating land use. It excludes the original road that developed as social infrastructure for the mobility of the population, but includes land required to expand the pavement footprint, due to increased freight demand.

Figure 11: Externality costs for 2010, 2011 and 2012



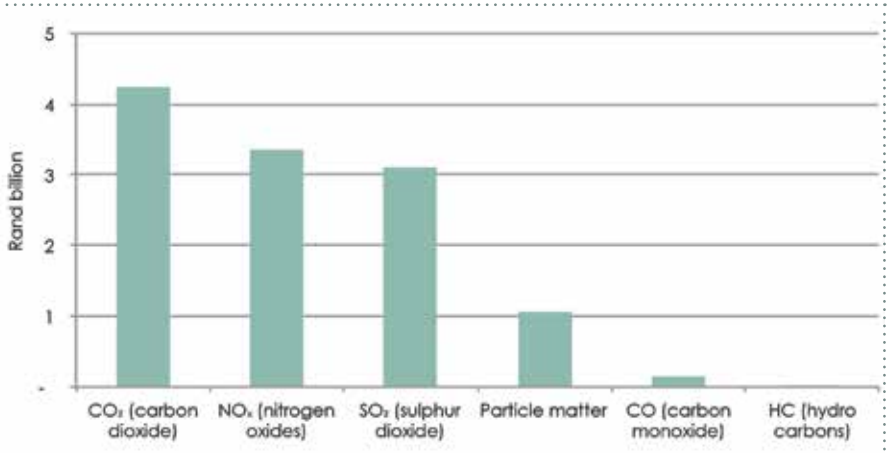
7 Swarts, S., King, D., Simpson, Z., Havenga, JH., and Goedhals-Gerber, L. 2012. Calculation of freight externality costs for South Africa. *Journal of Transport and Supply Chain Management.* 6(1): 207-222.

8 Havenga, JH., Simpson, Z., King, D., and Goedhals-Gerber, L. 2012. Calculation of freight externality costs for South Africa - a working paper. *Logistics Research Nerwork's 17th Annual Conference*. Cranfield, United Kingdom. Cranfield University 2012: 96.

Table 1: Revision of 2010 externality costs			
	2010 Previous (R billion)	2010 Revised (R billion)	% Change
Accidents	13.8	11.7	-15%
Emissions	6.5	11.5	+77%
Congestion	5.7	4.4	-23%
Noise	1.2	4.3	+259%
Policing	0.7	2.0	+177%
Land use		2.4	

Another fundamental change has been the inclusion of other emissions and not just CO_2 in the emissions costs. The components included in emissions costs are given in **Figure 12**.

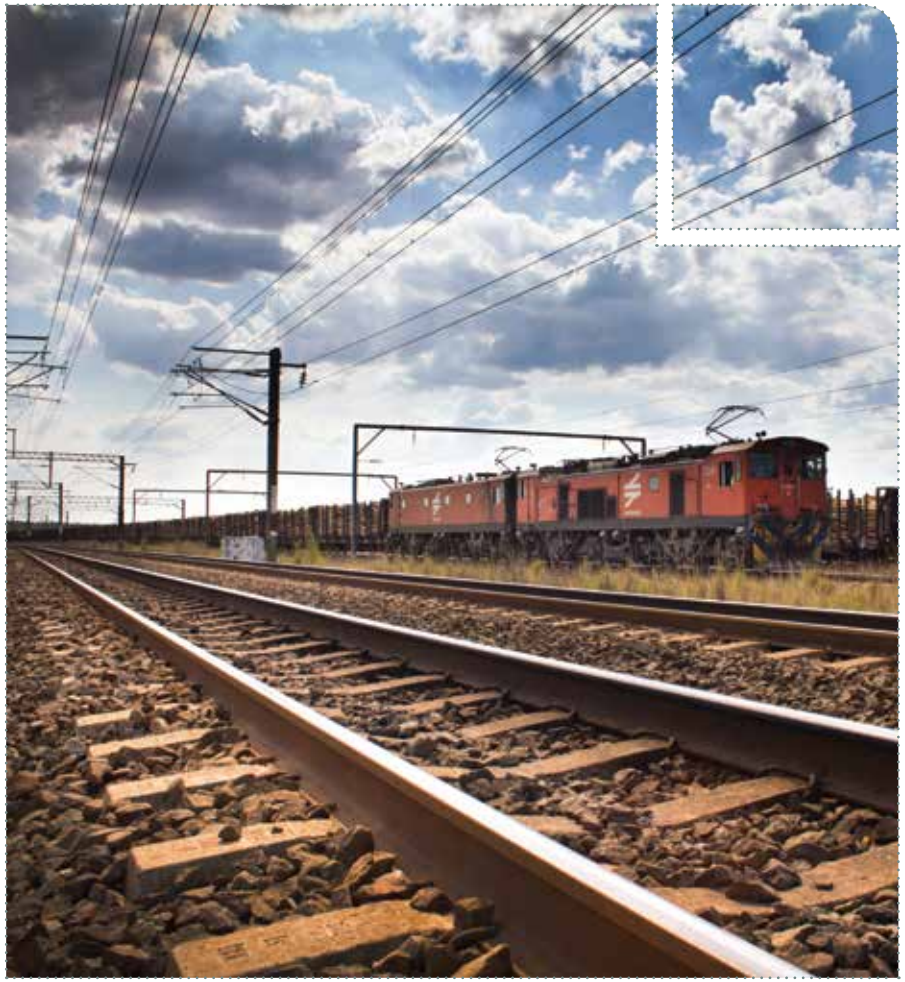
Figure 12: Emissions cost components for 2012 (E)



FREIGHT FLOW STATISTICS

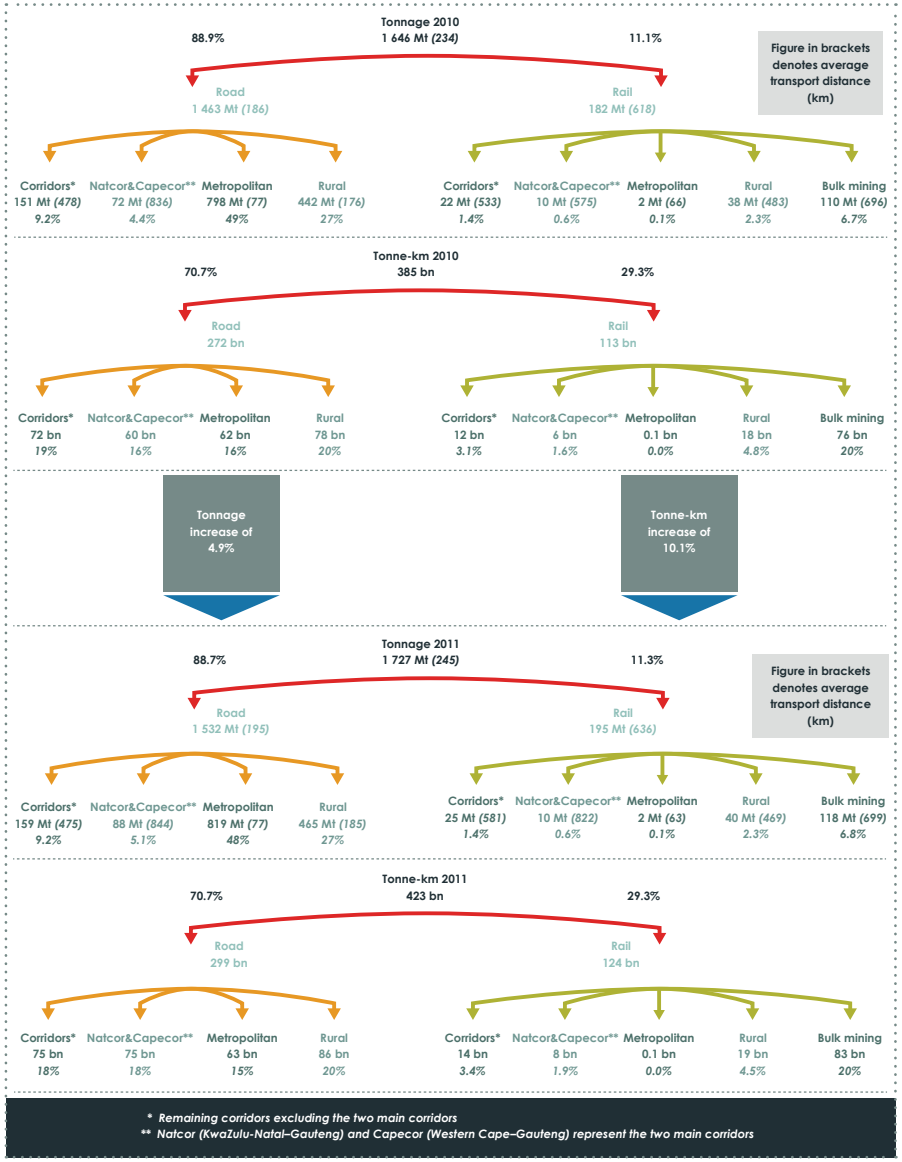
The total road and rail transport activity in the economy is depicted in **Figures 13 and 14**. Both 2011 and 2012 volumes have increased, measured in tonnes and tonne-km, but the growth for 2012 (+1.8% in tonnes, +2.1% in tonne-km) is estimated at a much lower rate than for 2011 (+4.9% in tonnes, +10.1% in tonne-km). Worth noting is the slight increase in rail market share, from 11.1% in 2010 to 11.5% in 2012 in terms of tonnes, and from 29.3% in 2010 to 29.9% in 2012 in terms of tonne-km.

The largest growth in tonnes transported was for the two main corridors (KwaZulu-Natal–Gauteng corridor and the Western Cape–Gauteng corridor), which saw an increase of 15.9% between 2010 and 2012 when combining road and rail. Similar growth is seen in tonne-km on these two corridors, increasing by 19.7% between 2010 and 2012. The average distances travelled on both road and rail increased in 2011, showing a change from the previous decreasing trend. The increase of freight traffic on corridors relative to freight traffic on the other typologies has been forecasted and quantified in Transnet's Freight Demand Model since 2007[9]. This has major implications for transport planning in South Africa and is an important modal shift target for the economy.



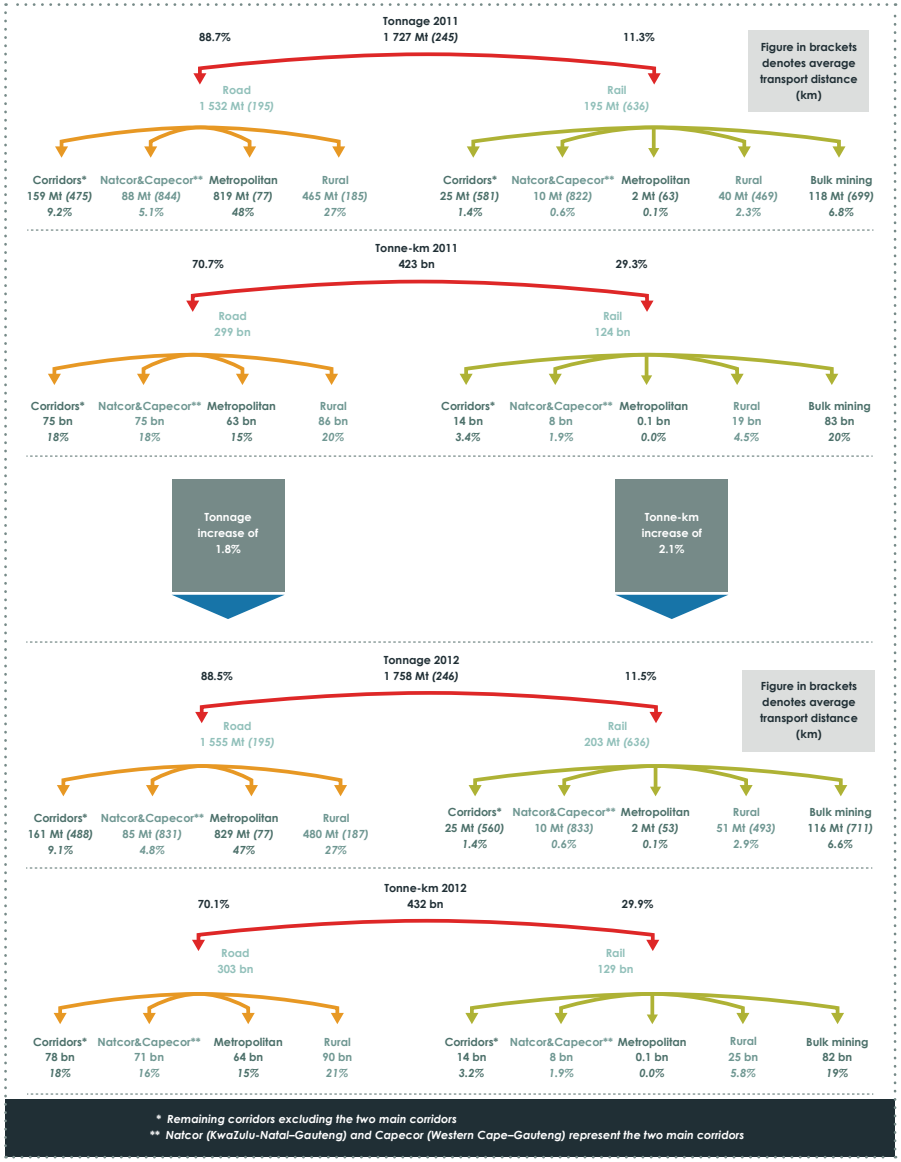
9 Havenga, JH. 2007. The development and application of a freight transport flow model for South Africa, dissertation presented for the degree of Doctor of Philosophy (Logistics Management): 189. Stellenbosch University, Stellenbosch.

Figure 13: Road and rail freight volumes for 2010 and 2011



* Remaining corridors excluding the two main corridors
** Natcor (KwaZulu-Natal–Gauteng) and Capecor (Western Cape–Gauteng) represent the two main corridors

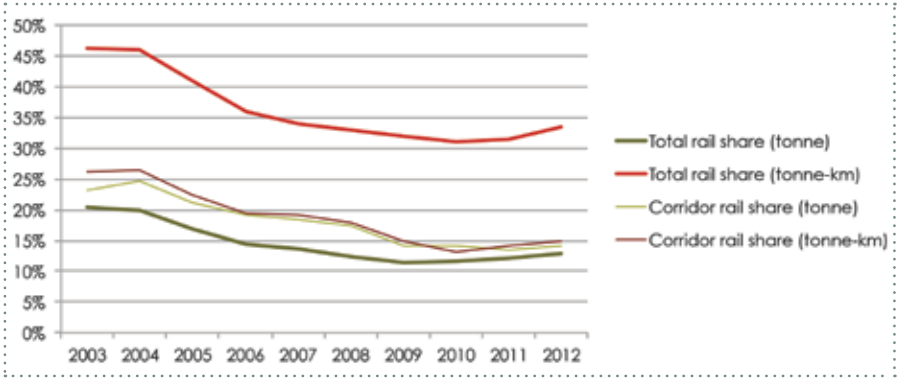
Figure 14: Road and rail freight volumes for 2011 and 2012



* Remaining corridors excluding the two main corridors
** Natcor (KwaZulu-Natal–Gauteng) and Capecor (Western Cape–Gauteng) represent the two main corridors

The market share performance for rail on all the major freight corridors over the past nine years is shown in **Figure 15**. The recent upswing in the rail share has occurred more rapidly than anticipated. The modal shift objectives of increasing bulk exports of coal and iron ore; recapturing both export and domestic bulk markets for other ores; and making first attempts to increase the high-value and corridor market shares are beginning to bear fruit. The modal shift strategy of increased rail investment and improved sevice levels should receive further support.

Figure 15: Rail market share since 2003



A NEW LOGISTICS PARADIGM

Logistics trends are driven by trade-off decisions. On an operational level, trade-offs may be between choices within a specific cost component such as using road or rail transport, or between cost components such as increasing delivery frequency (transport costs) to reduce inventory on-hand (carrying costs). At a strategic level, trade-offs exist between logistics and other marketing decisions, such as product, price and promotion. Globally, the trade-off has been made favouring economic specialisation and economies of scale while increasing logistics costs, all in pursuit of economic growth.

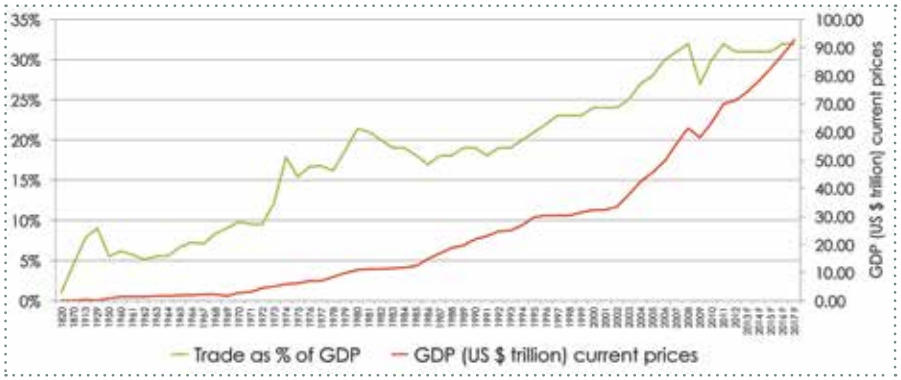
Economic specialisation increases time and place disparities, which increase the demand for logistics services. However, there is an indication that this trend has reached maturity in many highly developed economies and it is predicted that logistics's role as a facilitator of growth will decline as the need for industrial distribution activities contracts[10]. The great challenge that lies in this new era is a novel application of the logistics function, perhaps a deepening of the science that increasingly leverages non-physical elements such as knowledge management.

10 Klaus, P. 2009. Logistics research: a 50 years' march of ideas. *Logistics Research.* 1: 53-65.

A change in the role of logistics is not the only challenge facing the discipline. The rapidly changing landscape of environmental, fuel costs and supply security risk makes managing supply chains all the more complex[11,12]. On top of that, calculating the *real* cost of logistics, which includes those externalities that are currently borne by society and are thus cross-subsidised, and charging that to shippers and carriers is imminent. Because externality costs are currently paid by society at large, they do not form part of the on-going economic specialisation/logistics costs trade-off. New and innovative ways of improving logistics (and especially transport) efficiency and managing logistics demand are essential.

Reshoring, the practice of bringing supply (manufacturing) back closer to the shores where the actual demand occurs, is another trend changing the face of global logistics. A number of factors spur reshoring such as a rising Chinese middle class that has driven up wages, eroding the low-cost advantage of regional specialisation; and a drive to lower unemployment in the developed countries where the demand is concentrated in the first place. Reshoring is expected to decrease global trade as a percentage of global GDP in the next few years (**Figure 16**), having a profound effect on global logistics that is not yet fully understood. The current generation of leaders grew up in a world where global trade as a percentage of GDP doubled in three decades. The next three decades will probably see the exact opposite.

Figure 16: World trade as % of world GDP (US $ trillion) (International Monetary Fund[13], Van den Berg and Lewer[14])



11 Busicchia, B. 2013. *Horse meat scandal's long tail highlights risks of lengthy supply chains*. Available: http://theconversation.edu.au/horse-meat-scandals-long-tail-highlights-risks-of-lengthy-supply-chains-12396

12 Ruddick, G. 2013. *UK supply chains need overhaul to avoid new horse meat scandal, survey warns*. Available: http://www.telegraph.co.uk/finance/newsbysector/retailandconsumer/9922860/UK-supply-chains-need-overhaul-to-avoid-new-horse-meat-scandal-survey-warns.html

13 International Monetary Fund. 2013. *World Economic Outlook Update: Gradual Upturn in Global Growth During 2013*. Available: http://www.imf.org/external/pubs/ft/weo/2013/update/01/index.html

14 Van den Bergh, H. and Lewer, JJ. 2007. *International Trade and Economic Growth*. Armonk: M.E. Sharpe.

Eighty years ago global trade was described as an *engine of growth*[15], but this phrase was changed to global trade being a *handmaiden of growth*[16] 40 years ago. In the next 40-year wave (where we are now) new research might indicate that global trade is no longer necessarily conducive to growth at all. The term "Peak Globalization"[17] (related to "Peak Oil") was used for the first time in 2009. In 2010 Nussbaum warned that "*the international political consensus of the universal economic benefits of globalization that defined much of the 20th and early 21st centuries is breaking down*" and "*the tide of globalization washing across boundaries for so long has reached a peak and is receding*"[18]. The World Trade Organisation slashed its global trade forecast from 4.5% to 3.3% on 10 April 2013. This is not only a significantly slower growth rate than expected, the accompanying media statement by the Director-General, Pascal Lamy, states that annual rises of below the 20 year pre-2008 trend can be expected[19]. In fact, growth itself might be redefined[20,21].

Innovative solutions to global logistics challenges will come from both a supply and demand-side perspective. Supply-side solutions are well defined, including modal shift, better vehicle utilisation, improved fuel efficiency, efficient driving methods and cutting the carbon content of fuel. Demand-side solutions are currently less researched with disparate schools of thought on various topics such as the decrease in global trade, reshoring, recycling at source and even 3D printing.

Reshoring is definitely the one demand-side solution that has received the most attention. The recent release of the MIT's Forum for Supply Chain Innovation's survey on reshoring concludes that nearly half of the USA's manufacturers are considering reshoring[22]. The survey echoes the results of more informal surveys over the past two years where USA manufacturers indicated that in the first few months of 2012, they won new manufacturing businesses that were previously offshored. It is estimated that 2 to 3 million jobs and US $100 billion of local output could be created as early as 2015 by reshoring in the USA. Europe also drives reshoring, with support for local producers and the consequent lowering of 'food kilometres' a driving concern.

15 Robertson, DH. 1930. The future of international trade. *The Economic Journal.* March: 1-14.

16 Kravis, IB. 1970. Trade as a handmaiden of growth. *The Economic Journal*. December: 850-872.

17 Curtis, F. 2009. Peak Globalization: Climate change, oil depletion and global trade. *Ecological Economics*. 69: 427-434.

18 Nussbaum, B. 2010. *Peak Globalization.* Harvard Business Review Blog Network. Available: http://blogs.hbr.org/cs/2010/12/peak_globalization.html

19 Miles, T. 2013. *WTO slashes 2013 global trade growth forecast.* Business Day. 11 April 2013. Available: http://www.bdlive.co.za/world/2013/04/11/wto-slashes-2013-global-trade-growth-forecast

20 The first three "Degrowth" conferences were held in 2008, 2010 and 2012 in Paris, Barcelona and Montreal.

21 Schneider, F., Kallis, G., and Martinez-Alier, J. 2010. Crisis or opportunity? Economic degrowth for social equity and ecological sustainability. Introduction to this special issue. *Journal of Cleaner Production*. 18: 511-518.

22 Simchi-Levi, D. 2012. *U.S. Re-Shoring: A Turning Point*. Massachusetts Institute of Technology.

The major policy implications of these emerging logistics trends impact the areas of skills development, infrastructure development and trade facilitation. Skills development and infrastructure development are discussed in *Skills shortages and requirements in the logistics industry in South Africa* (pp 76-82) and *Transport infrastructure and planning* (pp 66-74), respectively. Part of the internal debate within countries and regions would be the configuration of export/import logistics infrastructure compared to what is required for domestic supply chains. Trade facilitation is a crucial mechanism in configuring domestic and regional trade volumes through a combination of supportive tax, duties and VAT deferment schemes.

Should GDP be the determining factor?

The view of sustainable development that calls for a balance between economic growth, social development and environmental protection (profit, people and planet)[23] has been generally accepted. However, some lament that the institutionalisation of the 'triple bottom line' has led to a hierarchical view that still prioritises GDP growth[24]. A more aggressive model challenges the balanced model by prioritising environmental protection above GDP growth. Though once labelled as activists, those punting the aggressive model are becoming increasingly mainstream[25]. In essence, the validity of GDP growth as the trumping development metric is being questioned[26].

GDP does not distinguish between speculative gains and real economic value and does not measure non-market activities that do contribute to growth. In social terms, GDP does not measure growth distribution at a household level; it measures quantity and not quality and does not distinguish between 'positive' welfare spending and 'defensive' spending. In the context of a world order where the limited scope for growth is explicitly recognised, maximisation of profit would no longer be the basis for allocating resources[27]. "*A downscaling of production and consumption that increases human well-being and enhances ecological conditions and equity on the planet*" is proposed[26]. GDP is not a suitable indicator for such a growth paradigm as social wellbeing indicators such as poverty rate, literacy and life expectancy are mostly excluded.

23 United Nations. 1987. *Report of the World Commission on Environment and Development: Our Common Future.* Available: http://www.un-documents.net/our-common-future.pdf

24 Sustainable Aotearoa New Zealand. 2009. *Strong sustainability for New Zealand: Principles and Scenarios*. New Zealand: Nakedize Limited.

25 Shutt, H. 1998. *The trouble with capitalism: an enquiry into the causes of global economic failure.* London: Zed Books.

26 Fioramonti, L. 2013. *Gross Domestic Problem: Economic Controversies*. Zed Books, Kindle Edition.

27 Daly, L. and Posner, S. 2011. *Beyond GDP: New measures for a new economy*. New York: Dēmos.

Nonetheless, the power of GDP to monitor short to medium-term fluctuations in economic activity cannot be ignored. For a long time to come, it will be the best single measure of how a market economy is performing. But its ability to measure longer-term progress is more doubtful and a clear case exists for complementing it with more robust long-term measures[28]. The implication is that new directions for measuring logistics costs in relation to growth (not just GDP) could be required in future.

CONCLUSION

Very few national logistics costs time series exist. The USA's and South Africa's time series indicate that transportation is becoming a larger portion of total logistics costs as the key underlying cost driver, namely the fuel price, has increased significantly over the past decade with no sign of respite in the upward volatility. In addition, 'visible' logistics costs will escalate further due to the inclusion of externality charges which will force a reduction in logistics's environmental footprint. This implies that the paradigm needs to be revisited where society, albeit not always consciously, has made the trade-off in favour of high logistics demand to drive economic growth through specialisation and economies of scale. From a logistics supply-side perspective, optimal modal balance and efficiencies can be engineered, but research is increasingly pointing to the reality that the most sustainable long-term approach would be to reduce the demand for material logistics services through, ultimately, reducing the total demand for material goods. This includes shifting the demand to locally available materials and produced goods as well as reshoring production in many supply chains. The mainstream focus on GDP as the key measure of national well-being is placed under scrutiny, implying that new methods for the measurement and comparison of logistics costs relative to growth will be required among nations.

28 Commission of the European Communities. 2009. *Communication from the commission to the council and the European Parliament: GDP and beyond: Measuring progress in a changing world*. Brussels, 20 August 2009. COM 433l.

INVESTIGATION OF ROAD FREIGHT CHALLENGES AND COSTS IN SOUTH AFRICA

Jankauskaite, Zivile (Taemané Blue), Gounder, Sada (Taemané Blue) and Bean, Wilna L (CSIR)

Freight transportation is a major enabler of economic activity; an inefficient freight transport system with high costs constrains the growth and competiveness of a country. The South African freight transport sector relies heavily on road transportation, with 70.1% of the total tonne-km in 2012 being on road. This article identifies specific challenges that increase road-freight transport costs as experienced by stakeholders in the freight transport sector of South Africa. In addition, the country's road freight cost components are compared with those of three developed countries namely the United Kingdom (UK), the United States of America (USA) and Australia, highlighting pertinent differences and similarities between the countries.

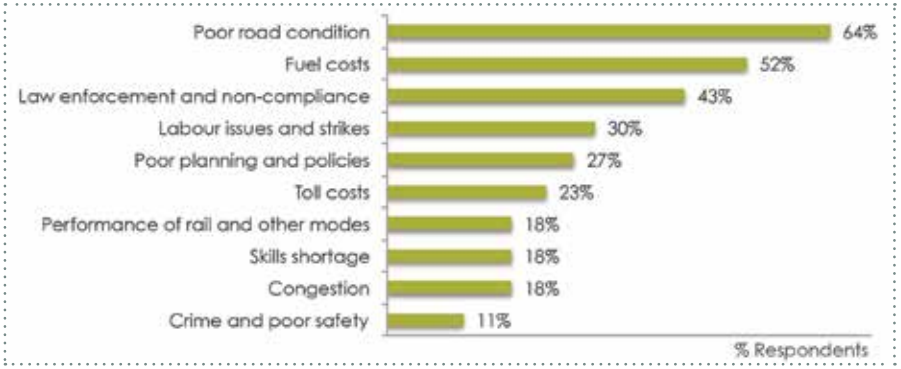
INDUSTRY PERSPECTIVE ON ROAD FREIGHT TRANSPORTATION

Key challenges and cost contributors

This section provides an overview of industry's perspective on the key challenges that impact road freight costs in South Africa. Data used for this investigation were gathered through various stakeholder engagement sessions and a questionnaire targeted at a diverse set of stakeholders operating in the South African freight transport sector. In particular, the 48 survey respondents consisted of 30% road freight transporters, 30% consignee and consignors, 23% industry associations, 10% consultants and 7% government organisations or agencies. The main industries in South Africa represented by these respondents were manufacturing, mining, chemical, agriculture, petrochemical, retail and fast-moving consumer goods.

The key issues experienced by stakeholders in the South African road freight transport sector are depicted in **Figure 17**.

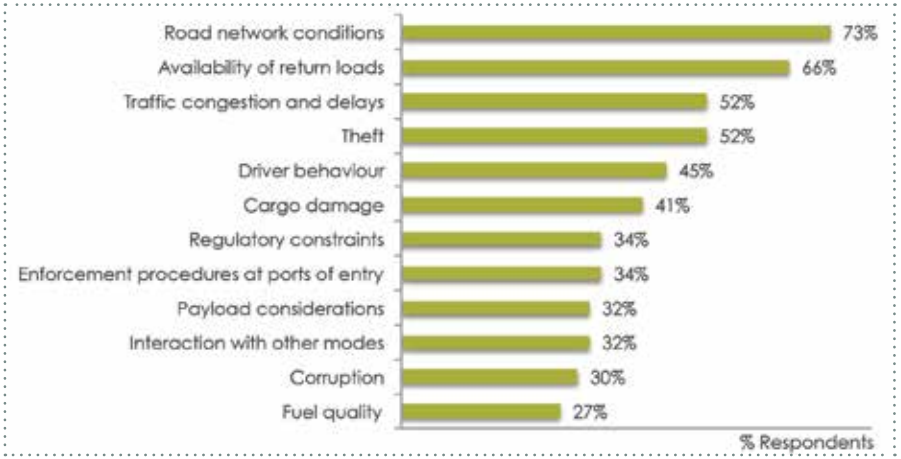
Figure 17: Industry perspective on key issues in the South African road freight transport sector



This figure indicates that 64% of all survey respondents felt that poor road conditions were one of the key issues in the sector. The cost of fuel was the second most worrying issue in the sector, with 52% of respondents being concerned about the fuel costs in the country. Conversely, only 18% of respondents identified rail performance, skills shortage and congestion as major challenges and around 11% of respondents felt that crime and poor safety were issues of concern.

Survey respondents also identified those factors that they felt influence road freight transport costs significantly in the country. These factors are shown in **Figure 18**.

Figure 18: Industry perspective on key road freight transport factors that influence costs



The majority of respondents (73%) felt that the condition of the country's road network contributes greatly to the cost of road freight transportation in the country. This was followed by the availability of return loads and the costs associated with empty returns (66%) as well as traffic congestion with its associated delays (52%), and theft (52%).

Situational analysis of road freight transport costs

A situational analysis regarding the costs in the road freight transport sector was performed by combining results and findings of the stakeholder engagement sessions and the questionnaire survey with findings from desktop studies and insights from the Global Competitiveness Index (GCI)[29]. Key findings regarding the factors that contribute significantly to road freight transport costs are summarised here.

Poor road conditions

Poor road conditions are a result of the underinvestment in road maintenance by provincial and local authorities; inefficient use of funds with low value for money; poor accountability on spending; failure of some provincial road management agencies; and the over-utilisation of the road network. The impacts of poor road conditions on road freight costs mainly manifest through direct increases in vehicle operating costs and increased travel distances due to detours, resulting in decreased operational efficiency.

Fuel costs

High fuel costs are a result of South Africa's dependence on crude oil imports and subsequent exposure to global oil price fluctuations; increasing fuel taxes and levies; the Rand exchange rate; the Competition Commission unearthing collusion between oil companies; as well as the poor quality of fuel and congestion which lead to increased fuel consumption. The consequences of higher fuel costs are increased logistics costs and lower profitability of operating companies, which ultimately result in consumers paying more for products.

Law enforcement and non-compliance

A lack of law enforcement and rampant non-compliance by some road-freight users contribute to poor road safety, increased road maintenance costs due to overloading and unfair competition. Some of the root causes to this problem are corruption; inadequate policing; fragmented law enforcement agencies; as well as overloading and an inefficient overload-control penalty system.

29 World Economic Forum. 2012. *The Global Competitiveness Report 2012/2013.* Insight Report. Geneva, Switzerland.

Labour strikes and instability

Labour strikes and their associated instability result in low productivity, and influence customer service delivery negatively. In addition, inflexibility in wage determination leads to high entry-level wages that discourage companies from hiring entry-level staff.

Government planning and policies

Inadequate coordination among government departments and agencies; skills shortages; poor implementation of plans; poor institutional arrangements between national, provincial and local government levels; data shortages; a lack of integrated transport policies; and other policy decisions result in many challenges in South Africa's road freight sector. Some of the most notable impacts manifest through increased operating costs; increased difficulty to import and export goods; higher greenhouse gas emissions; and lower quality fuel due to inadequate legislation governing fuel quality in the country.

Toll costs

The high toll costs in South Africa are a result of policy decisions on road infrastructure provision and maintenance, resulting in higher operating costs and consequently higher inflation rates.

Congestion

Increased congestion on the country's road network is a result of unsophisticated load and delivery scheduling and a lack of capacity, exacerbated by the inadequate performance and coverage of rail transportation. These result in delays, a decrease in reliability and a loss of productivity, which drives up product costs and eventually the inflation rate.

Skills shortages

Although not a problem limited to the road freight sector, the sector experiences a huge skills shortage in terms of qualified drivers and technicians. These shortages impact vehicle repair and maintenance costs, accident rates, fuel consumption, vehicle lifespan and vehicle downtime. Skills shortages in the freight transport sector also result in increased wage pressures and cost of skills development.

Poor performance of rail

A large proportion of rail-friendly cargo is currently transported on road, increasing transport costs, road deterioration rates and congestion. Industry cites poor service and high pricing by the country's rail operator as the main cause for this modal imbalance.

Crime and safety concerns

Increased insurance costs, increased transport costs due to the adoption of additional safety measures and ultimately the reduced ability of companies to satisfy demand are the consequences of crime and safety concerns in the sector.

INTERNATIONAL ROAD FREIGHT COST COMPARISONS

Investigating the challenges, solutions and comparative road transport cost characteristics of different countries provides the opportunity to identify and propose a set of measures and solutions for South Africa to improve the efficacy of road transportation and, consequently, its global competitiveness. This section presents the international benchmarking of road freight transport costs in South Africa with selected globally competitive, developed countries that have relatively advanced road transport infrastructure and systems. This comparison is done in terms of road infrastructure costs, industry-level road freight costs, toll costs, and the company-level transport operating costs.

For the purposes of this international cost benchmarking study the UK, the USA and Australia were chosen. These countries were selected due to their advanced transport systems, regulations and policies as well as their high rankings in the GCI where the USA and the UK were rated in the top 10 and Australia in the top 20, compared to South Africa in 52nd place.

Road infrastructure costs

A comparison between South Africa's road construction and maintenance costs and those of the other three countries is provided in **Table 2**. South Africa has the lowest per lane-km road construction cost of R30 million, followed by Australia with R48.3 million, the UK with R51.3 million and the USA with road construction cost of R56.3 million per lane-km. Similarly, South Africa's road maintenance costs are also the lowest between the four countries at R0.3 million per lane-km, followed by Australia with R0.5 million, the USA with R2.3 million and the UK with R2.4 million. South Africa's construction to maintenance cost

ratio is 100, which is similar to the ratio of 97 for Australia, whilst the UK and the USA are similar to each other with ratios of 21 and 23, respectively.

Table 2: Comparison of road infrastructure costs [30,31,32,33,34,35]

Road infrastructure cost factor	UK	USA	Australia	SA
Road construction costs (R million/lane-km)	51.3	56.3	48.3	30.0
Road maintenance costs (R million/lane-km)	2.4	2.5	0.5	0.3
Road construction/Maintenance costs	21	23	97	100

South Africa's construction costs are the lowest, mainly due to South Africa being a lower cost, developing country. The lower road maintenance costs in South Africa are due to the high quality national roads in the country. Conversely, the USA's road network condition is considered to be old and deteriorating, requiring higher maintenance costs per lane-km.

The high construction to maintenance cost ratio in South Africa can be attributed to various factors including the exchange rate, relatively lower labour costs and less maintenance conducted on the country's road network. On the other hand, Australia's higher construction to maintenance cost ratio is as a result of investing in better quality roads to minimise road maintenance requirements and costs.

Industry-level road transport costs

The industry-level transport costs of the UK, the USA, Australia and South Africa are compared in **Table 3.**

30 HM Treasury. 2010. *Infrastructure Cost Review: Technical Report*. Infrastructure UK. London, UK.

31 National Audit Office (NAO). 2009. *Contracting for Highways Maintenance*. Report by the Controller and Auditor General HC 959. October 2009.

32 Archer, C. and Glaister, S. 2006. *Investing in Roads: Pricing, Costs and New Capacity*. Department of Civil and Environmental Engineering. Imperial College, London.

33 Adams, T. 2011. *Estimating Cost per Lane Mile for Routine Highway Operations and Maintenance*. Project 07-12, Midwest Regional University Transportation Center. University of Wisconsin. Madison, WI.

34 Research and Innovative Technology Administration (RITA). 2012. *National Transportation Statistics 2011*. Bureau of Transportation Statistics. U.S. Department of Transportation.

35 Bureau of Infrastructure, Transport and Regional Economics (BITRE). 2011. *Australian Infrastructure Statistics Yearbook 2011*. Canberra.

Table 3: Comparison of industry-level road transport ratios [36,37,38,39,40,41,42,43]

Industry-level ratios	UK	USA	Australia	SA
GVA (road transport)/GDP	1.3%	0.8%	1.6%	1.1%
Road transport costs/GDP	2.5%	4.1%	3.1%	4.7%

The Gross Value Added (GVA) of road transportation as a percentage of the Gross Domestic Product (GDP) varies from 0.8% in the USA to 1.6% in Australia. South Africa and the UK seem to have similar percentages with 1.1% and 1.3%, respectively, but comparing the underlying causes is difficult due to the differences in their economies.

Road transport costs as a percentage of GDP is the highest in South Africa at 4.7%, followed by 4.1% in the USA, 3.1% in Australia and 2.5% in the UK. One of the major contributors to South Africa's relatively high percentage is the fact that South Africa's economic hub, Gauteng, is located inland, far from the nearest port. This is unlike the comparison countries where the main economic hubs – London, New York and Sydney – are all located closer to ports.

Toll costs

Toll costs as a percentage of freight operator costs for the four countries are generally low, ranging from 3.8% in Australia to less than 0.5% in the UK[44,45,46,47]. The percentage in South Africa is second highest at 2.6% followed by the USA with 1.7%.

36 Office for National Statistics (ONS). 2012. *National Accounts, Chapter 19, Section 19.4 Gross value added at current basic prices by industry*. London.

37 Klaus, P. 2012. *Measuring the Size of Logistics Markets and Logistics Cost: Findings from the 2011 European "Top 100" Study*. International Transport Forum 2012 Annual Summit. 2 May 2012. Leipzig, Germany.

38 SEALS Consortium: ProgTrans AG, ECORYS, Fraunhofer ATL, and TCI Röhling. 2008. *Statistical Coverage and Economic Analysis of the Logistics Sector in the EU (SEALS), Final Report*. Prepared for the European Commission, DG Energy and Transport.

39 Council of Supply Chain Management Professionals. 2010. *21st Annual State of Logistics Report*. Washington, D.C.

40 Council of Supply Chain Management Professionals. 2011. *22nd Annual State of Logistics Report*. Washington, D.C.

41 Council of Supply Chain Management Professionals. 2012. *23rd Annual State of Logistics Report*. Washington, D.C.

42 Bureau of Economic Analysis (BEA). 2012. *Annual Industry Accounts: Advance Statistics on GDP by Industry for 2011*. U.S. Department of Commerce. Washington, D.C.

43 Bureau of Economic Analysis (BEA). 2012. *GDP by Industry Value Added, 1998-2011*. U.S. Department of Commerce. Washington, D.C.

44 National Treasury. 2012. *Reply to Parliamentary Question Number: 140 [CW190E]*. 16 March 2012. Pretoria.

45 Bureau of Infrastructure, Transport and Regional Economics (BITRE). 2011. *Public Road-related Expenditure and Revenue in Australia.* Information Sheet 40. Canberra.

46 American Transportation Research Institute (ATRI). 2011. *An Analysis of the Operational Costs of Trucking: A 2011 Update*. Arlington, VA.

47 Freight Transport Association (FTA). 2012. Fuel price and duty update: Budget 2012, Available: http://www.fta.co.uk/export/sites/fta/_galleries/downloads/fuel_prices/fuel_price_and_duty_update_budget_2012.pdf.

However, it is important to understand that a parallel can be drawn only between the application of toll revenues in Australia, South Africa and the USA as these countries use toll fees as a source of revenue. Conversely, the UK government does not really consider toll fees as a major source of revenue as a greater share of revenue is generated through fuel levies, which are considered to be the highest in Europe. Another important factor to consider is that Australia and the USA use toll fees as congestion charges and these values vary between peak and off-peak periods. On the contrary, South Africa applies fixed toll fees per vehicle class irrespective of the time of day or congestion level, the exception being the time-of-day[48] discounts that SANRAL will allow on Gauteng Freeway Improvement Project toll roads in Gauteng once these are implemented.

Company-level operating costs

A comparison between the various freight transport operating cost-drivers of the different countries[49,50,51,52,53,54,55,56,57] indicated that similar costing structures exist in the UK and the USA, with some 30% fixed costs and 70% variable costs. Conversely, South Africa and Australia have higher fixed costs at around 60% and lower variable costs of 40%. The higher fixed-cost component in South Africa and Australia is due to these countries having to import most of their trucks. In addition, security concerns in South Africa lead to higher insurance costs in the country.

In all four countries the highest fixed-cost driver was the cost of truck drivers, followed by vehicle depreciation costs. The highest variable cost-driver for all four countries was fuel costs, followed by vehicle maintenance and repair costs. Combined, fuel costs and truck driver costs varied between 55% and 70% of total company operating costs in the four countries.

48 Government Gazette Vol 568. Pretoria, 25 October 2012. No.35756.

49 Road Haulage Association (RHA). 2010. *Goods Vehicle Operating Costs RHA Cost Tables 2010*. Prepared by DFF International.

50 Road Haulage Association (RHA). 2011. *Goods Vehicle Operating Costs RHA Cost Tables 2011*. Prepared by DFF International.

51 Road Haulage Association (RHA). 2012. *Goods Vehicle Operating Costs RHA Cost Tables 2012*. Prepared by DFF International.

52 American Transportation Research Institute (ATRI). 2011. *An Analysis of the Operational Costs of Trucking: A 2011 Update*. Arlington, VA.

53 American Trucking Associations (ATA). 2011. *American Trucking Trends 2011*. Arlington, VA.

54 TransEco. 2011. *Road Freight Cost Outlook Quarterly Report*. Melbourne. 1(1).

55 Bureau of Infrastructure, Transport and Regional Economics (BITRE). 2011a. *Truck productivity: Sources, Trends and Future Prospects*. Report 123. Canberra.

56 Bureau of Infrastructure, Transport and Regional Economics (BITRE). 2010. *Road Freight Estimates and Forecasts in Australia: Interstate, Capital Cities and Rest of State*. Report 121. Canberra.

57 FleetWatch. 2010, 2011 and 2012. *Truck Operating Cost Benchmarks*. Available: www.fleetwatch.co.za

CONCLUSION

The analysis of road freight transport challenges and costs indicate that there is considerable scope for improvement and cost reduction in the road freight transport sector of South Africa. The key challenges experienced by stakeholders in the sector are primarily linked to the country's road infrastructure, government service delivery, as well as a lack of policies and the implementation of these to promote an efficient and productive road transport sector. If South Africa can address some of the challenges identified, the country's freight transport costs will be reduced, resulting in increased regional and global competitiveness.

THE POTENTIAL EFFECTS OF DETERIORATING ROAD CONDITIONS IN SOUTH AFRICA

Steyn, Wynand JvdM (University of Pretoria)
and Bean, Wilna L (CSIR)

Having the required logistics infrastructure in place is a critical prerequisite to successfully enable a country's integration with its neighbours, thereby enhancing its regional competitiveness. Even though South Africa is in a fortunate position to have a relatively extensive logistics infrastructure network in place, maintaining and upgrading this network generally seems problematic. This is particularly true for the South African road network and as most freight is transported by road, it is imperative to keep the network in a good condition.

The importance of a good quality road network is generally acknowledged and various projects were undertaken by the South African National Road Agency Limited (SANRAL) in the past decade to upgrade, improve and maintain South Africa's national road network. However, it still seems as if the maintenance and upgrading of the country's provincial road networks (secondary network) are far lower on the list of priorities. This could be because most road freight is transported on the country's national road network, creating the perception that the condition of the secondary road network is not as critical for efficient and cost-effective freight transport.

The reality is that a large proportion of freight is still transported on the secondary network, especially in the agriculture, mining and forestry sectors. Poor road conditions can have a significant impact on the logistics costs and the operations of businesses in these sectors. In addition, a safety concern is associated with poor road condition as it causes, or contributes to, many fatal accidents.

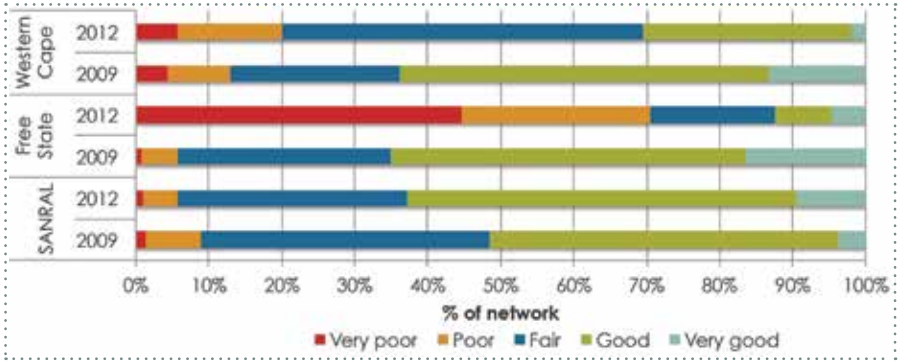
To put the spotlight on the importance of maintaining the country's road networks in a good condition, it is essential to get a handle on the effect that deteriorating road conditions can have on the logistics operations and economy of South Africa. Understanding that the benefit of maintaining a road far outweighs the costs of not doing so, will be supported by knowledge of what it would cost the country when acceptable road conditions are not maintained and what savings could accrue if they are.

This article builds on work published in the annual State of Logistics™ survey since 2009 regarding the potential effect of deteriorating road conditions on the South African logistics sector. It provides an overview of the current condition of the South African road network, how it has changed since 2009 and how bad roads affect vehicle operating costs. In addition, the cost of fatal road accidents caused by poor road conditions is quantified.

OVERVIEW OF THE SOUTH AFRICAN ROAD NETWORK CONDITION

Figure 19 shows a comparison of the condition of some of the paved road networks in 2009 and 2012. The primary road network includes all the national roads and is mainly owned and maintained by SANRAL. Its condition improved significantly over the past couple of years, due to various upgrade and maintenance projects. Based on the latest available data it seems that the secondary road network was, in general, not maintained adequately and had deteriorated since 2009.

Figure 19: Comparison of the condition of paved road networks in 2009 and 2012 (SANRAL[58])



The most noticeable deterioration in road condition is in the Free State road network, where the percentage of poor or very poor roads increased from around 6% to over 70%. The Free State's economy is highly dependent on the mining and agriculture sectors. Mines and farms are often located far from metropolitan areas and are not always directly connected to the national road network or railway lines, resulting in the need to transport

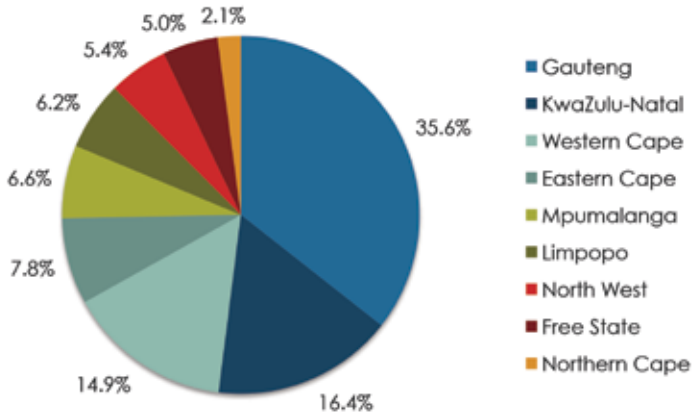
58 Road network condition data provided by Louw Kannemeyer. SANRAL.

goods by truck on provincial roads from mines and farms to the national road network or rail sidings. This usage of provincial roads to transport bulk commodities together with the lack of investment in maintenance most likely resulted in this disproportional deterioration. The Western Cape's provincial road network condition has also deteriorated from having around 13% of poor or very poor roads to around 20%.

The most recent road network condition data for the provincial road networks in Gauteng, Limpopo, Mpumalanga, North West, Eastern Cape, Northern Cape and KwaZulu-Natal are still outstanding and will be reported on in the next State of Logistics™ survey. However, indications are that the conditions of these provincial road networks have also deteriorated since 2009.

It is important to acknowledge that freight traffic on the road network of a province or the deterioration of the road condition is not necessarily directly proportional to the economic activity of the province. **Figure 20** shows each province's contribution to the South African economy in 2011[59]. It is interesting to note that, despite the major deterioration in the Free State road network, the province contributes only around 5% to the national economy. Through-traffic could account for that portion of road deterioration that does not correlate directly with provincial economic activity, but it is difficult to assess how much of the through-traffic did, in fact, travel on the provincial road network. For example, most of the trucks transporting freight on the corridor between Gauteng and the Port of Durban pass through the Free State, however, they primarily use national routes so the economic activity in Gauteng that causes the freight traffic cannot be linked directly to the freight volumes or road deterioration on the Gauteng, Free State or KwaZulu-Natal provincial road networks.

Figure 20: Provincial contribution to the national economy in 2011

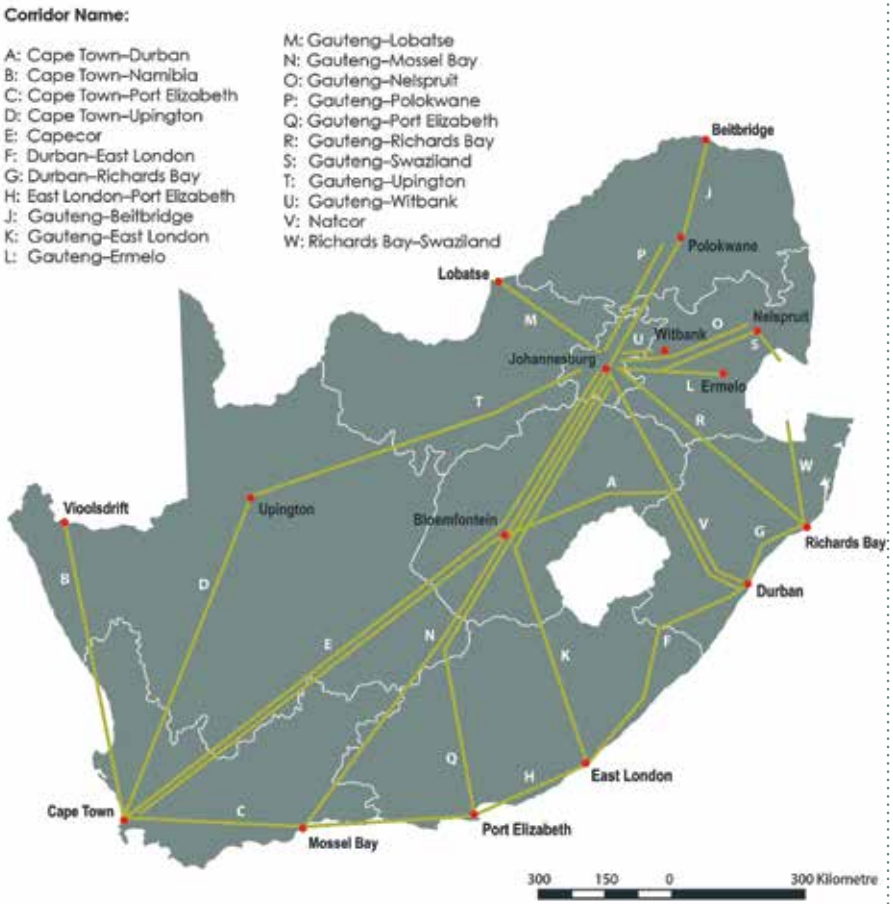


59 Gauteng Provincial Government. 2012. *Provincial Economic Review and Outlook 2012*. Technical report. Available: http://www.finance.gpg.gov.za/GDFDocuments/PERO/Provincial%20Economic%20Review%20Outlook%202012.pdf.

EFFECTS ON VEHICLE OPERATING COSTS

Most of the road-freight volumes in South Africa travel along recognised freight corridors that comprise almost exclusively the national road network. Therefore, to develop a comprehensive understanding of the potential effect of road conditions on fuel, tyre and vehicle maintenance and repair costs, an analysis was done on the 22 main road freight corridors in South Africa, as shown in **Figure 21**.

Figure 21: Main road freight corridors taken into account in the study[60]



60 Adapted from: Ittmann, H., Schoeman, C., King, D., and Mashoko, L. 2011. *Global Perspectives – South Africa*. Council of Supply Chain Management Professionals (CSCMP). (Figure created by Dr Peter Schmitz from the CSIR.)

The analysis focused on freight transportation (using 2011 road-freight volumes data) and determined the total fuel consumption, tyre costs and annual vehicle repair and maintenance costs for freight transported on the 22 main corridors using NCHRP720 formulas[61]. These formulas were developed by the Transportation Research Board (TRB) for the United States of America (USA). The basis of these formulas is similar to the Highway Development and Management System Version IV (HDMIV) model[62,63]. Previous studies conducted in South Africa validate the results generated for South Africa using these formulas despite the fact that minor discrepancies may arise from using the USA paradigm[64]. A process has been launched to calibrate these formulas specifically for the South African road freight context.

The study calculated a weighted riding quality, based on the 2009 road conditions indicated in **Figure 19** for the selected 22 corridors to determine the expected condition of each of the corridors. This condition data were used with road-freight volumes on each of the corridors to calculate the fuel, tyre and additional vehicle damage costs, using the NCHRP720 formulas. Two separate cases were analysed. Firstly, using only the national road network data, the impact of a 10% improvement and 10% deterioration of road conditions on the main corridors was investigated (see **Table 4 and Table 5**, respectively). Secondly, the provincial road network data were used to analyse what the effect would have been if freight on the road corridors travelled mostly on the provincial as opposed to the national road network (**Table 6**). The results of the second analysis emphasise the major benefit that the availability of a high-class national road network has on freight logistics costs in South Africa.

61 Chatti, K. and Zaabar, I. 2012. *Estimating the Effects of Pavement Conditions on Vehicle Operating Costs.* National Cooperative Highway Research Program (NCHRP), Report 720. Transportation Research Board. Available: http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_720.pdf.

62 Bennett, CR. and Greenwood, ID. 2003a. *Volume 5: HDM-4 Calibration Reference Manual*. International Study of Highway Development and Management Tools (ISOHDM). World Road Association (PIARC).

63 Bennett, CR. and Greenwood, ID. 2003b. *Volume 7: Modeling Road User and Environmental Effects in HDM-4*, Version 3.0. International Study of Highway Development and Management Tools (ISOHDM). World Road Association (PIARC).

64 Steyn, WJvdM., Bean, W., King, D., and Komba, J. 2011. Evaluating Selected Effects of Pavement Riding Quality on Logistics Costs in South Africa. *Transportation Research Record – Journal of the Transportation Research Board*. 3(2227): 138-145.

Table 4: Corridor fuel consumption and cost comparison between the actual and a 10% better road condition

Freight transport total	Actual road conditions on corridors	10% Improvement in road conditions	Difference	% Decrease from actual
Total annual fuel consumption for all corridors	5 669 502 kℓ	5 665 185 kℓ	4 317 kℓ	0.08%
Total annual fuel costs (based on average diesel price for 2011 of R9.2/ℓ[65])	R52.159 billion	R52.119 billion	R40 million	0.08%
Total annual tyre costs for all corridors	R2.629 billion	R2.624 billion	R5 million	0.16%
Total annual repair and maintenance costs for all corridors – damage caused by vibrations only	R1.958 billion	R1.904 billion	R54 million	2.74%

Table 4 indicates a potential saving of almost R100 million per year in fuel, tyre and vehicle repair and maintenance costs, if there were a 10% improvement in the overall condition of the national road network. Seeing that the national road network is currently in a good condition, it is critical for it to be kept that way. Not doing that could result in various cost increases as illustrated in **Table 5**. In this table a 10% deterioration in riding quality was assumed on the 22 road freight corridors used in the analysis, leading to additional costs of around R107 million per year that would directly affect truck operator profitability.

Table 5: Corridor fuel consumption and cost comparison between the actual and a 10% worse road condition

Freight transport total	Actual road conditions on corridors	10% Deterioration in road conditions	Difference	% Increase from actual
Total annual fuel consumption for all corridors	5 669 502 kℓ	5 674 250 kℓ	4 748 kℓ	0.08%
Total annual fuel costs (based on R9.2/ℓ[65])	R52.159 billion	R52.203 billion	R44 million	0.08%
Total annual tyre costs for all corridors	R2.629 billion	R2.633 billion	R4 million	0.18%
Total annual repair and maintenance costs for all corridors – damage caused by vibrations only	R1.958 billion	R2.017 billion	R59 million	3.02%

65 Department of Energy. 2011. *Fuel Price History for 2011. Republic of South Africa.* Available: http://www.energy.gov.za/files /esources/petroleum/Dec2011/FuelPriceHistory.pdf.

The second analysis, shown in **Table 6**, compares what the fuel consumption and costs would have been if the freight traffic on the corridors travelled mainly along the provincial instead of the national road networks. The data indicate an increase of 28 864 kℓ in fuel consumption, R28 million in tyre costs and a R358 million increase in additional vehicle repair and maintenance costs. This translates to around 0.03% of GDP or 16% of the country's provincial road transport budget for the 2010/2011 financial year. This illustrates the benefit of having a generally good quality national road network available in South Africa.

Table 6: Comparison between traffic flowing on national and provincial road networks through 22 corridors

Freight transport total	Actual national road network	Actual provincial road network	Difference	% Increase between actual and provincial costs
Total annual fuel consumption for all corridors	5 669 502 kℓ	5 698 366 kℓ	28 864 kℓ	0.51%
Total annual fuel costs (based on R9.2/ℓ)	R52.159 billion	R52.425 billion	R266 million	0.51%
Total annual tyre costs for all corridors	R2.629 billion	R2.657 billion	R28 million	1.08%
Total annual repair and maintenance costs for all corridors – damage caused by vibrations only	R1.958 billion	R2.316 billion	R358 million	18.34%

Even though the national road network is generally in a good condition, it is important to note that vehicle operating costs could increase significantly if maintenance of these good roads was neglected. Furthermore, great potential exists for reducing overall transportation costs if provincial roads were improved as the national road network does not always offer the shortest route. If provincial roads were in a much better condition, they could be included in the 22 main freight corridors. It is estimated that an improvement in road condition of around 25% should be possible on all provincial road networks.

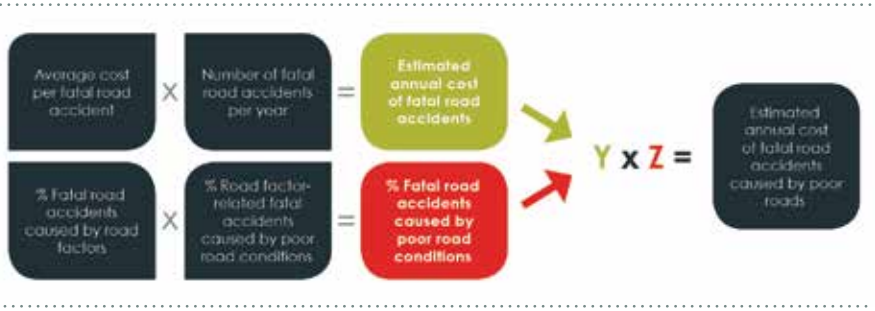
EFFECTS ON ROAD SAFETY

The effects of poor road conditions extend far beyond increased costs to companies. Poor road conditions are often causes or contributory factors to road traffic accidents in South Africa. Seeing that South Africa is notorious for its high road accident fatality rates, it is important to know what the actual effect of poor road conditions are on road safety and its associated costs. This would illustrate that benefits will also be realised in this challenging area when the country's roads are improved and kept in a good condition.

The causes of road accidents are typically divided into three categories namely human, vehicle or road causes. The percentage contribution of road-related factors to fatal road traffic accidents is estimated to be between 5% and 15%[66]. Of this, 28.14% can be attributed directly to a poor road surface condition[67]. This indicates that the loss of many human lives as well as various costs relating to road traffic accidents could have been avoided if roads were adequately maintained.

This section showcases a preliminary study to determine the cost of fatal road accidents caused by poor road conditions and strives to highlight that the financial implications of poor road conditions extend far beyond increased costs to companies. The approach taken to estimate the costs is summarised in **Figure 22**.

Figure 22: Determining the annual cost of fatal road accidents caused by poor road conditions



Due to the unavailability of more recent data, the average cost per fatal road accident in the 2010/2011 financial year was determined by dividing the 2007 annual cost of fatal road accidents with the total number of fatal road accidents in the same year[68] and then inflating the figure with the 2008, 2009 and 2010 inflation rates provided by Statistics South Africa. The number of fatal road accidents for the 2010/2011 financial year was obtained

66 Peltser, K. 2008. Road use behaviour in Africa. *4th International conference on traffic and transport psychology*. Washinton, D.C. 1 September 2008. Invited keynote address.

67 Road Traffic Management Corporation (RTMC). 2011. State of Road Traffic Report 2010/11. *In the Road Traffic Management Corporation Annual Report 2010/11*. Available: http://www.rtmc.co.za/RTMC/Files/RTMC%20AR/RTMC%20AR%202010%20-%202011.pdf.

68 Road Traffic Management Corporation (RTMC). 2008. *Year 2007 Road Traffic Report*. Technical Report. Available: http://www.rtmc.co.za/RTMC/Files/Traffic_Reports/Calendar%20Year/Year%202007%20Road%20Traffic%20Report.pdf.

from the State of Road Traffic Report 2010/2011[69]. The estimated annual cost was then multiplied with the percentage of fatal road accidents caused by poor road conditions to determine the annual cost of fatal road accidents caused by poor road conditions in the country.

Results indicate that the estimated cost of fatal road accidents caused by poor road conditions in South Africa for 2010/2011 is between R207 million and R621 million. This translates to between 0.008% and 0.023% of GDP. This effect may appear insignificant in terms of GDP, but the effect of human lives lost in an industry with limited resources is significant and should be appreciated. In addition, it is important to note that these costs should be much higher if the cost of non-fatal accidents and increases in health and social development budgets dealing with road traffic accidents were taken into account.

Even though there could be some inaccuracies in the source data due to various uncertainties and data capturing challenges, the estimated cost of fatal road accidents provides an initial idea of the potential effects that poor road conditions have on road safety and related costs in the country. This shows that the benefits extend far beyond just facilitating the efficient transportation of freight and that many other challenging areas could be impacted positively by keeping South Africa's roads in an acceptable condition. One such area is the reduction of fatal road traffic accidents, as the number of fatal road accidents caused by poor road conditions in 2010/2011[70] was estimated to be between 153 and 458 at a cost of approximately R1.35 million per incident.

CONCLUSION

The effects that poor road conditions have on a country can be significant and this article further investigated the potential effects that deteriorating road conditions could have on the economy of South Africa.

An overview of the 2012 road network conditions of three of the road management authorities in the country was provided and compared with those of 2009. This comparison showed that South Africa's national road network improved over the past couple of years, mainly due to various road upgrade and maintenance projects undertaken by SANRAL. However, the condition of the country's provincial road network generally deteriorated even further from 2009, clearly indicating that efforts to maintain and improve provincial roads during the past four years were inadequate.

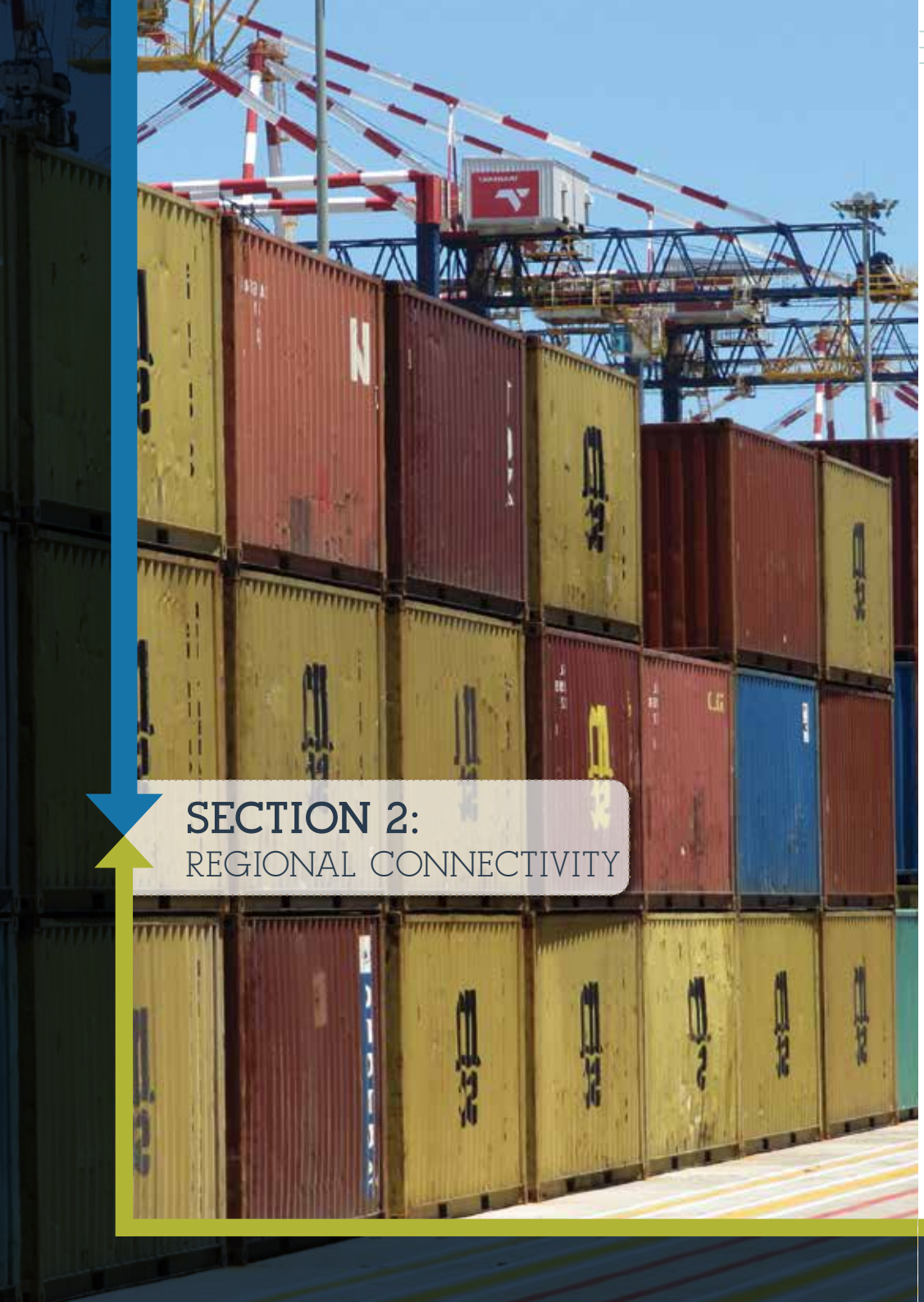
A study on the effects of deteriorating road conditions on fuel consumption, tyre costs and truck maintenance and repair costs was conducted for the 22 main road freight transport corridors in the country. Results indicated that annual fuel consumption, total annual tyre costs and total annual truck maintenance and repair costs on these corridors could potentially increase with 0.08%, 0.16% and 2.74%, respectively, should road conditions deteriorate by 10%.

Poor road condition also has a decided impact on road safety as it is one of the causes of fatal road accidents in South Africa. A preliminary study on the cost of fatal road accidents as a result of poor road conditions estimated that the cost is between R207 million and R621 million annually.

Ensuring that the required logistics infrastructure is in place and in an acceptable condition in South Africa is an important step towards enabling regional integration and enhancing global competitiveness. It is therefore important for decision-makers in the country to understand and acknowledge the negative effects that poor road conditions can have on the economy. The benefits that result from upgrading and maintaining the country's road network far outweigh the costs of not doing so.

69 Road Traffic Management Corporation (RTMC). 2011. State of Road Traffic Report 2010/11. *In the Road Traffic Management Corporation Annual Report 2010/11*. Available: http://www.rtmc.co.za/RTMC/Files/RTMC%20AR/RTMC%20AR%202010%20-%202011.pdf.

70 Road Traffic Management Corporation (RTMC). 2011. State of Road Traffic Report 2010/11. *In the Road Traffic Management Corporation Annual Report 2010/11*. Available: http://www.rtmc.co.za/RTMC/Files/RTMC%20AR/RTMC%20AR%202010%20-%202011.pdf.



SECTION 2:
REGIONAL CONNECTIVITY

DEVELOPING THE SADC PORT COMMUNITY

Viljoen, Nadia M (CSIR)

The author wishes to express her sincere appreciation to the Georgia Tech Logistics Innovation and Research Center (http://www.gatech.pa) for providing the database required for the connectivity analysis and to Pablo Achurra for key inputs on the maritime industry.

INTRODUCTION

Global cargo shipping is a complex network of interdependent, densely connected port communities. One cannot, however, truly capture the regional or global role that a specific port plays by merely using the port's individual key performance indicators (KPIs), or using statistical analyses of aggregate freight flows between ports. Recently, experts have turned to complex network theory to analyse maritime connectivity within the global cargo shipping network and to better understand how market dynamics and political agendas impact this network[71,72,73]. *Connectivity* is the measure of a port's access to global liner services and consequently its access to global markets. Viljoen and Bartholdi[74] discuss two published connectivity metrics that calculate the centrality (or relative importance) of nodes within the maritime network. The United Nations Conference

71 Ducruet, C. et al. 2010. Centrality and vulnerability in liner shipping networks: revisting the Northeast Asian Port hierarchy. *Maritime Policy & Management*. 37(1): 17–36.

72 Kaluza, P., Kölzsch, A., Gastner, MT., and Blasius, B. 2010. The complex network of global cargo shipping movements. *Journal of the Royal Society Interface*. 7:1093-1103.

73 Montes, C., Seoane,MJ., and Laxe, F. 2012. General cargo and containership emergent routes: A complex networks description. *Transport Policy*. 24 : 126–140.

74 Viljoen, NM. and Bartholdi, JJ. III. 2012. Maritime connectivity of South African ports. *8th State of Logistics™ survey for South Africa 2011*. CSIR. Pretoria. 68–77.

on Trade and Development (UNCTAD) publishes the Liner Shipping Connectivity Index (LSCI) that calculates the centrality of countries based on the volumes of incoming and outgoing container traffic[75]. The Port Connectivity Index[76] calculates centrality at a port level to determine the importance of a port, based on the importance of the other ports it is connected to.

Table 7 shows the ranking of the coastal Southern African Development Community (SADC) countries among 157 coastal countries included in the LSCI over the past three years. Not surprisingly, South Africa is considered the most central of the SADC countries in terms of container shipping but it is interesting to note Mauritius's position, which results primarily from its importance as a transhipment hub.

Table 7: Ranking of coastal SADC countries among 157 coastal countries according to the LSCI index (2010–2012)[77]

	RANKING		
	2010	2011	2012
South Africa	33	30	39
Mauritius	63	70	50
Namibia	69	75	72
Angola	78	81	76
Madagascar	102	98	84
United Republic of Tanzania	79	78	86
Mozambique	95	84	90
Seychelles	120	103	110
Democratic Republic of Congo	118	140	138

Generally, the better connected a port is (i.e. the higher its centrality) the more competitive it is within the global network. But this rings true for communities of ports as well. In this article, we consider port communities to be a collection of individual ports that are in close geographical proximity along with the major world regions to which they are connected through maritime trade. Port communities that have dense intra-community connections and are well connected to other significant world regions are prime candidates to serve as gateways and/or transhipment hubs for the major global maritime shipping routes.

The global cargo shipping network can essentially be partitioned into three distinct networks that differ not only in the vessels' physical characteristics, but in mobility patterns and network structure: bulk dry carriers, container ships and oil tankers[78]. Given the large inland economies in southern Africa, for example Gauteng in South Africa, standardised intermodal containers are of paramount importance if we want to switch between modes (maritime to road, or maritime to rail) as quickly as possible. Standardised intermodal containers are also the common currency for large-scale transhipment hubs, a maritime market worth pursuing. If SADC were to be positioned as a well-connected maritime cluster supporting one or more world-class transhipment hubs, it would hold immense benefit for the inland supply chains and create the opportunity for the region to earn revenue from cargo that is passing the southern tip of Africa on the Cape Route, destined for other continents. Therefore, this article investigates, from a container-shipping perspective, the transhipment potential of SADC and compares its port community structure to three other prominent maritime transhipment communities, namely South East Asia, the Caribbean and the Mediterranean.

TRANSHIPMENT PROSPECTS FOR SADC

The increase in cargo availability has spurred the building of larger vessels to capitalise on economies of scale which, in turn, largely influence the reshaping of liner services to rely heavily on high-volume global maritime shipping routes – specifically on the East–West trade lanes between the USA and Europe and Asia[79]. These trends have created a strong business case for dedicated transhipment terminals that serve as a crossing point for major trade lanes as well as a collection and distribution point to serve supply chains on nearby continents. Transhipment volumes have been increasing steadily and are expected to keep increasing in the medium-term despite temporary contraction following the global financial crisis (**Figure 23**).

75 United Nations Conference on Trade and Development (UNCTAD). 2011. *Review of Maritime Transportation 2011*. United Nations, Switzerland. ISBN 978-92-1-112841-3: 90.

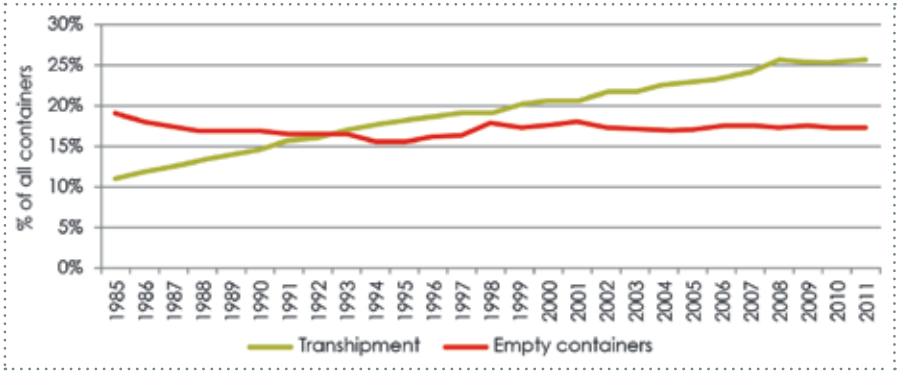
76 Bartholdi, J., Jarumaneeroj, P., and Ramudhin, A. 2013. *A new connectivity index for container ports*. Technical report. Supply Chain and Logistics Institute. Georgia Tech.

77 UNCTADSTAT. 2011. Liner shipping connectivity index, annual, 2004-2012. United Nations Conference on Trade and Development. Available: http://unctadstat.unctad.org/ReportFolders/reportFolders.aspx

78 Kaluza, P., Kölzsch, A., Gastner, MT., and Blasius, B. 2010. The complex network of global cargo shipping movements. *Journal of the Royal Society Interface*. 7:1093-1103.

79 Notteboom, T. and Rodrigue, J. 2005. Port regionalization towards a new phase in port development. *Maritime Policy & Management*. 32(3): 297-313.

Figure 23: Global transhipment containers and empty containers as % of total global container movements[80]



In SADC the opportunities for increased transhipment are two-fold. Firstly, a well-connected community with efficient feeder services could offer more direct shipping alternatives, pass on savings earned through economies of scale and possibly present coastal shipping alternatives for more arduous inland transportation routes. Secondly, there is untapped potential in container volumes already passing by South Africa on the Cape Route as well as container volumes that could sensibly shift to the Cape Route from the Suez Canal Route.

Under assumptions of rising bunker fuel costs, increasing vessel size and prevalent slow steaming practices, the Cape Route is highly favourable to the Suez Canal Route for trade lanes between West Africa–Oceania; West Africa–East Africa; and the South America East Coast–East Africa (see **Figure 24**). In addition, the Cape Route could compete for a number of other trade lanes on the basis of port efficiency, ship services and market demand[81]. Having more container traffic passing by on the Cape Route creates the potential for transhipment business.

In particular, three trade lanes have been identified that could benefit from a transhipment hub in SADC. Trade between Asia and the East coast of South America grew by approximately 58% to 1.2 million TEUs[82] in 2010[83]. The increased freight flow makes larger vessels viable, but shallow drafts on the East coast of South America limits their use. SADC is well positioned to serve as a transition point from larger vessels crossing the

80 Sooredoo, N. 2012. Historical TEU throughput. Drewry: London.

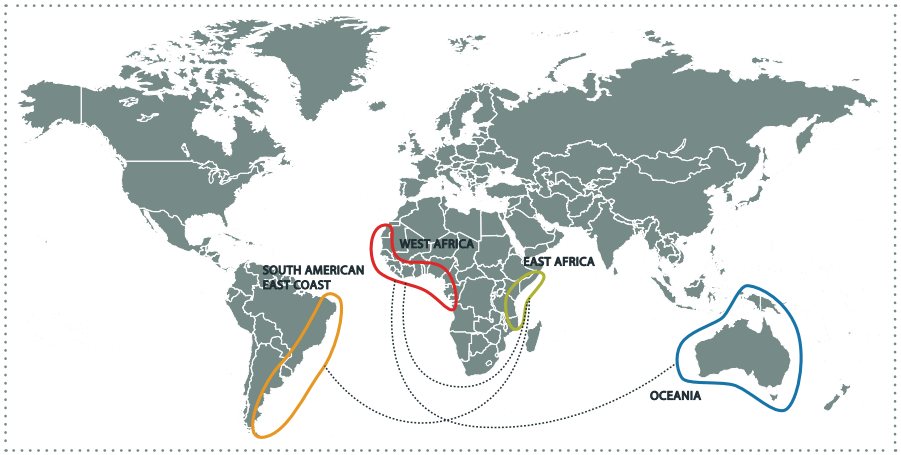
81 Notteboom, TE. 2012. Towards a new intermediate hub region in container shipping? Relay and interlining via the Cape route vs. the Suez route. *Journal of Transport Geography*. 22:164-178.

82 A Twenty-Foot Equivalent Unit (TEU) is a standard unit for expressing a vessel's cargo carrying capacity. One TEU implies a rectangular shape with dimensions 20x8x8 feet.

83 Department of Transport. 2011. Part 3: Transhipments. NDoT SA Maritime Transport Sector Study / Part 3/ 27 July 2011 Available: http://www.transport.gov.za/LinkClick.aspx?fileticket=mtEOPCEYiWQ%3D&tabid=331&mid=1786

Indian Ocean to smaller vessels crossing the Atlantic Ocean. SADC can play a similar role for trade between Asia and East Africa where containers on larger vessels from Asia are currently being placed on 1 500 TEU vessels in the Middle East. Lastly, if the piracy trends continue on the Suez Canal Route, a transhipment hub in SADC becomes an attractive alternative to current hubs in the Mediterranean for containers from Asia to West Africa[84].

Figure 24: Major global shipping routes for which the Cape Route is favourable to the Suez Canal Route in terms of distance and travel time



The Caribbean, Mediterranean and South East Asian port communities each contain significant regional transhipment hubs and have well-established intraregional feeder networks. For this reason the network structure of the SADC maritime community is compared to these three communities.

THREE TRANSHIPMENT COMMUNITIES...AND SADC

Although the focus of this investigation is maritime connectivity, a port community does not exist in isolation of its hinterland network, which consists of inland transportation, various types of freight terminals, consumer populations and economic centres[85]. In fact, port activity is highly influenced by the market dynamics in the hinterland. Thus, in describing the port communities it is worthwhile noting the differences in their hinterlands.

The Caribbean (CAR) port community includes ports in the Bahamas, the Caribbean,

84 Department of Transport. 2011. Part 3: Transhipments. NDoT SA Maritime Transport Sector Study / Part 3/ 27 July 2011. Available: http://www.transport.gov.za/LinkClick.aspx?fileticket=mtEOPCEYiWQ%3D&tabid=331&mid=1786

85 Notteboom, TE. 2012. Towards a new intermediate hub region in container shipping? Relay and interlining via the Cape route vs. the Suez route. *Journal of Transport Geography*. 22:164-178.

the Caribbean coast of Central America and the Northern coast of South America. This community encompasses a number of small islands whose economies and populations depend greatly on international trade, all conducted via maritime shipping. The lack of a well-connected, efficient inland transport network to support most of the Central American and South American ports also makes those economies highly dependent on maritime shipping to connect intraregionally. The Caribbean ports are on the doorstep of the Panama Canal and have quick access to the Gulf and East coasts of the USA and the North and East coasts of South America, making it a region that experiences incredible container through-traffic volumes.

The Mediterranean (MED) port community includes all West and East European, North African and Middle Eastern ports bordering the Mediterranean Sea. The Western European ports have well-established hinterland economies with good connectivity to Northern Europe. The East European ports serve hinterlands riddled with political and cultural barriers and a less well-connected inland transport system. The Middle Eastern ports serve a geographically large hinterland and are positioned where the Suez Canal opens up into the Mediterranean. The North African ports have poor inland transport connectivity and serve far poorer consumer populations. The majority of container volumes on the East–West trade lanes pass through this port community with a significant portion of that volume destined for gateway ports in the western waters of the Mediterranean Sea.

The South East Asia (SEA) port community is famous for its transhipment hubs at the Port of Singapore and Port Klang in Malaysia, two neighbouring island communities that have made most of their strategic geographic position close to China and on the favourable maritime route between the Americas and the Indian Ocean. The community also includes a number of low-cost manufacturing economies such as the Phillipines, Vietnam, Indonesia and Thailand and these economies are highly dependent on maritime shipping due to their island status or poor inland transport networks.

SADC ports also enjoy a strategic geographical position on the Cape Route, which is expected to see significantly increased container trade in the near future. SADC represents large and growing consumer populations and economies. Compared to the other three port communities, SADC does not have a strong, historical culture of regional shipping, having previously depended on inland transport for limited freight flows between countries (many of which are landlocked). Historically reliant on South Africa's transport infrastructure as a gateway to the region, SADC is only now proactively developing inland corridors to connect regionally (see *Inland connectivity in SADC*, pp 57-64). Despite its commonalities, SADC is not a fully-fledged transhipment community. Durban's position on the global container shipping stage notwithstanding, capacity issues and a lack of regional connectivity prevent the Port of Durban from single-handedly driving the maritime competitiveness of SADC. The remainder of this article uses complex network analysis to characterise and compare the community structures of the four communities.

CONNECTED COMMUNITIES

Data for the connectivity analysis were supplied by the Georgia Tech Logistics Research and Innovation Center. The database includes 463 commercial ports. Each record in the database represents a direct link between any two of these ports (referred to as a port pair). A direct link implies that one or more liner services visited these two ports in sequence. The number of services directly linking these two ports, the number of companies participating in these services, the number of vessels deployed on these services and the weekly allocated TEUs on these services were recorded for each link once a month for 11 consecutive months (November 2011 – September 2012).

Creating the individual community datasets from the global dataset was done as follows: All ports that fell within the CAR, MED and SEA communities according to the classification of the original maritime database, or within SADC (according to its accepted political definition), were retained as individual nodes in their respective communities. All links between ports in the same community were unchanged. All other ports that fell outside of the community in question were combined and represented by regional nodes.

For example, all the ports on the East coasts of the USA, Canada and Mexico as well as the Gulf coast of the USA were combined and represented as a single node labelled *East Coast of North America*. The links a specific port *within* the community had with ports that were combined into the East coast of North America node were also combined and the values for the number of services, number of companies, number of vessels and weekly allocated TEUs on those links were aggregated. Records in the database that represented links between two ports that were both outside the community (for example the link between Rotterdam and Antwerp) were deleted. The individual datasets for the communities of CAR, MED, SEA and SADC were uploaded into Gephi[86] wherein all network analyses were conducted, using the number of services as the weight parameter for each link.

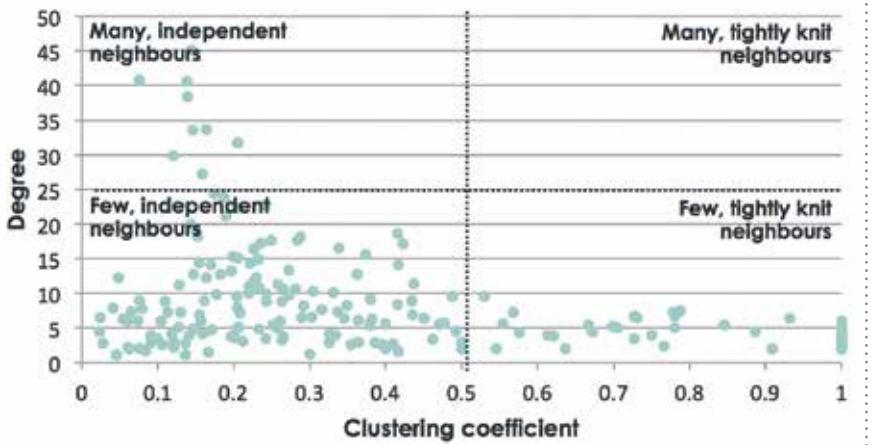
The purpose of the analysis was to compare the community structure of the three established transhipment communities with that of SADC. Two metrics were specifically investigated, the centrality[87] score and the clustering coefficient of the nodes in the community. The centrality score captures the importance of a node based on the importance of the nodes it is connected to as well as the weight of those connections. Likening it to social networks, your importance is based on how many friends you have, how important those friends are and how strong your relationships are with those friends. The clustering coefficient of an individual node indicates what fraction of that node's neighbours is connected to each other – it's a measure to determine how tightly knit a network is.

86 Open source software available from https://gephi.org

87 A weighted PageRank centrality algorithm was used with parameters p=0.85 and ε=0.001

Figure 25 plots the clustering coefficient (a fraction between zero and one) of the individual nodes in all four communities against the degree (number of neighbours) that each node has. In the case of these four communities, those nodes that have the most neighbours generally have a lower clustering coefficient.

Figure 25: Clustering coefficient versus degree for nodes in the four communities.



Figures 26 to 29 show the network diagrams constructed in Gephi for the four communities. The layout of the nodes in the diagram is determined by an algorithm that likens the weight of the links to a gravitational pull, so the nodes' relative positions on the diagram are likened to their relationships to other nodes. The size of the node is indicative of its centrality within the community. The thickness of the links is relative to the number of services between the port pairs. Red nodes symbolise individual ports within the community whereas the green nodes symbolise the collective ports in a world region that form part of the community structure.

It is important to keep in mind that these diagrams do not represent port capacity or actual freight flow, but rather the strength of connections between, and relative importance of community members. Also, the four diagrams are not drawn to the same scale and thus node sizes and link widths should not be compared directly between the four diagrams.

Figure 26: Network structure of the South East Asian (SEA) port community

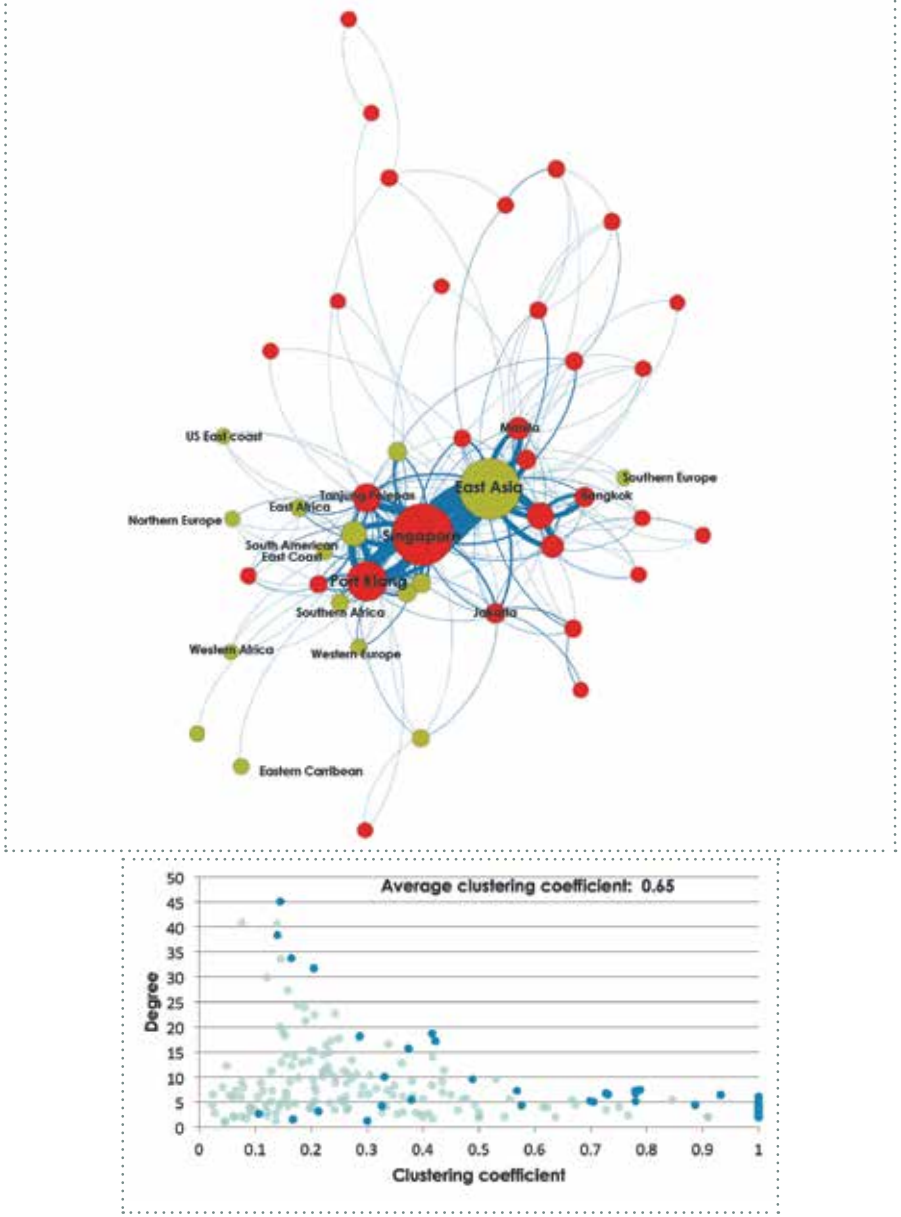
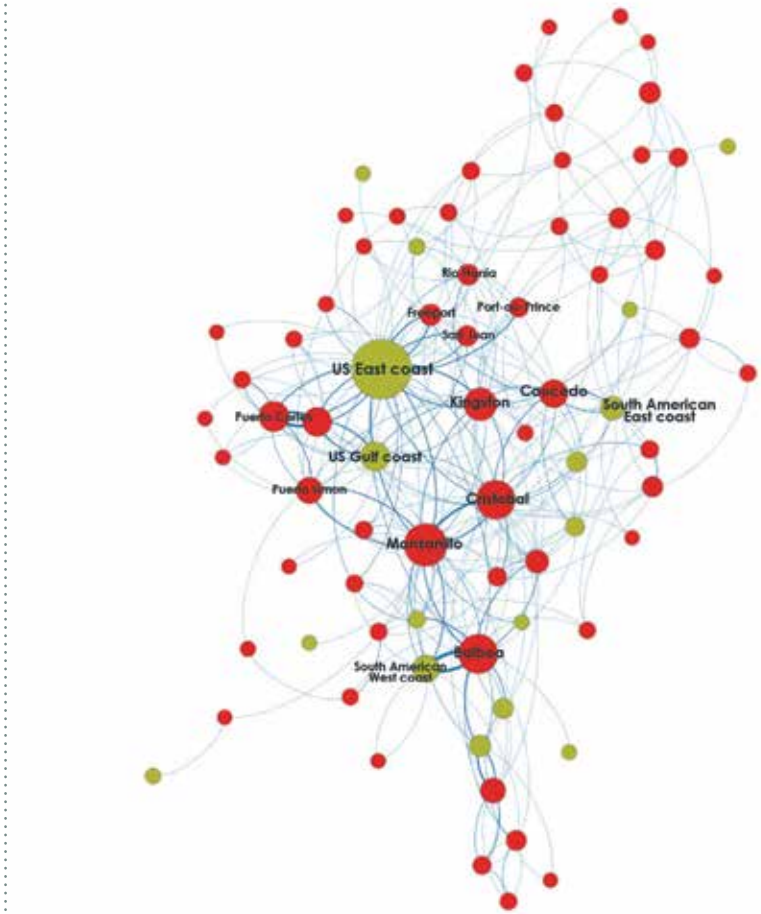


Figure 26 shows that SEA is a very tightly knit community centred around the economy of China (East Asia world region) and the two transhipment hubs of the Port of Singapore, Singapore and Port Klang, Malaysia. With an average clustering coefficient of 0.65, the graph shows that overall, nodes in this community have a higher clustering coefficient than in the other communities. Although a number of nodes are on the outskirts of the network diagram, their neighbours are within the tightly knit core cluster of the network, ensuring that the outlying nodes are still well-connected by association.

Figure 27 shows that the US East coast region plays the dominant role in the CAR community with the Panamanian ports (Manzanillo, Balboa and Cristobal) and Kingston, Jamaica being the most prominent of the community ports. This rings true as the US economy and the Panama Canal are the key maritime business drivers in the Caribbean. The relative sizes of the nodes indicate that only a few community ports have a higher–than-average centrality score. The community, with an average clustering coefficient of 0.33, is not as densely clustered as SEA. The graph shows that the community structure is much more dispersed with many ports having only a few neighbours that are greatly independent of each other.

Figure 27: Network structure of the Caribbean (CAR) port community



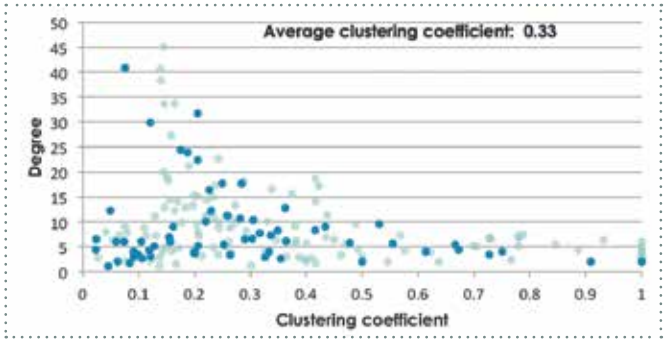
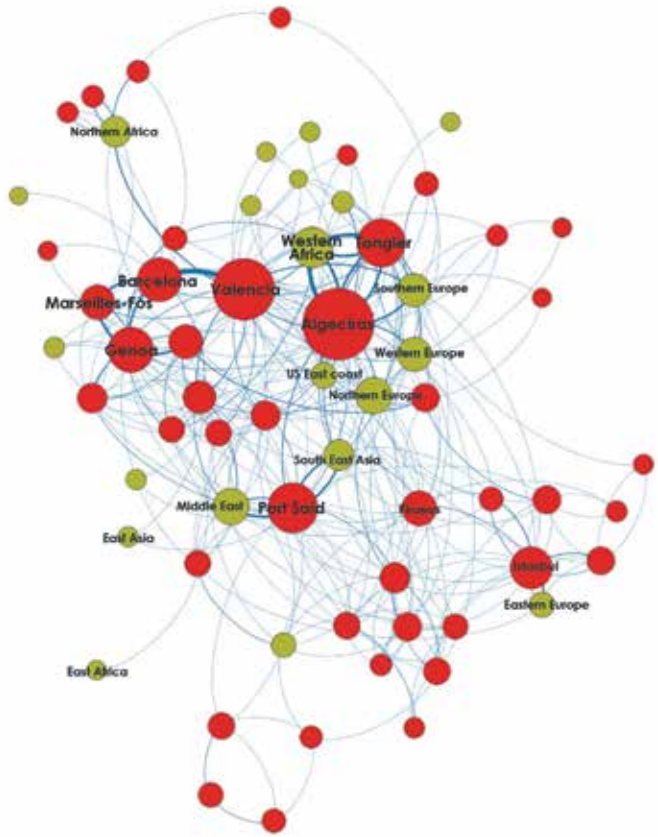


Figure 28: Network structure of the Mediterranean (MED) port community



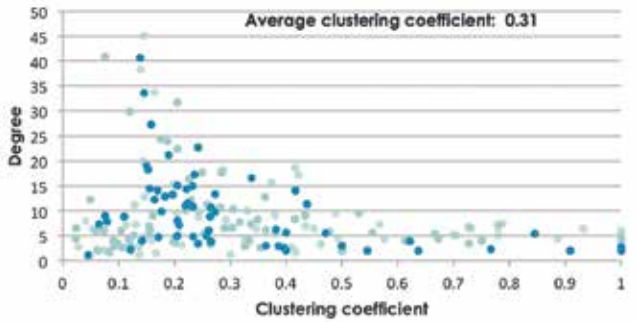
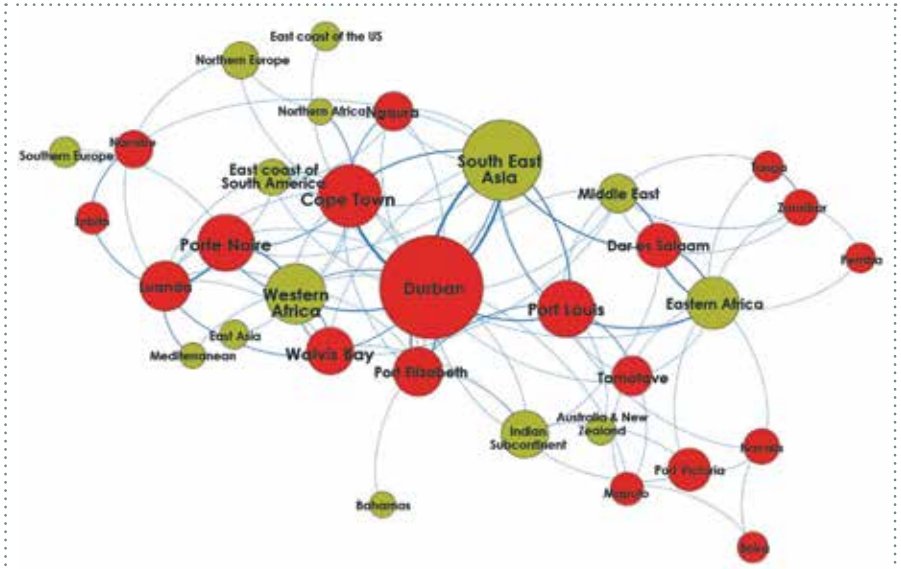
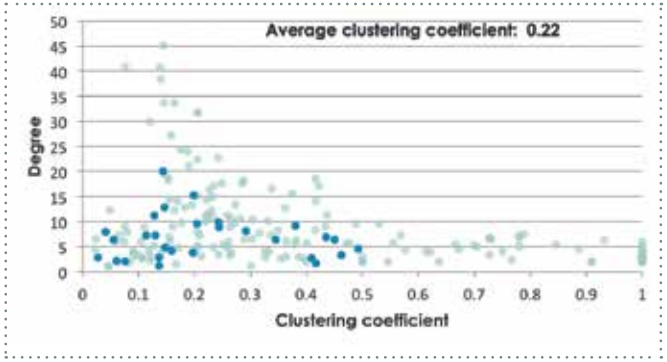


Figure 28 shows that the MED community is very similar to the CAR community in terms of its clustering coefficient with an average score of 0.31 and a distribution very similar to that of CAR. However, more of the community ports in the MED community have a higher-than-average centrality (node size). One explanation could be the strength, independence and dispersion of the hinterland economies that lie behind some of these ports as the MED community serves a number of different markets.

Figure 29: Network structure of the SADC port community





The most notable difference between the SADC port community and the others is the low number of ports in the community that connect to the world regions. This is a

result of the continental geography and a lack of emphasis on maritime trade in the past decades (**Figure 29**). The diagram echoes insights from the Port Connectivity Index, showing Durban and Port Louis as prominent role players with Cape Town, Port Elizabeth and Walvis Bay being well connected.

The importance of South East Asia in the community springs from the fact that many container shipments bound for SADC from around the world must first be transhipped, often onto smaller vessels, in SEA. Transhipment requirements may also be an explanation of the relative importance of Eastern and Western Africa (apart from geographic proximity). According to the average clustering coefficient (0.22), the community is less tightly knit than the CAR, MED and SEA communities. From the distribution of the clustering coefficient, all the ports have only a few neighbours that are independent of one another. One of the causes of this sparse network is the shortage of frequent feeder services between community ports.

The role of external world regions in these localised geographic communities is also apparent from the network diagrams. Where the CAR and SEA communities are anchored by economies outside of their community and thus political and economic control, namely the American and Chinese economies, the communities in MED and SADC are anchored by hinterland economies governed by the same political and economic powers as those that govern the ports in the community. This emphasises the role the SADC countries have to play collectively in developing the maritime community – ultimately proactive change will have to come from inside SADC as it will not be a reactive result of growth in external economies.

MAKING SADC A WORLD-CLASS TRANSHIPMENT COMMUNITY

Ultimately, the market power in the maritime industry lies with the shipping lines and the freight forwarders who decide where and how cargo will be shipped[88,89,90,91]. The SADC region cannot alter its geographic location, but two key competitive elements should be pursued by the region as a whole:

- **Hinterland connectivity and quality of logistics services.** The efficiency and connectivity of inland transport systems is a crucial deciding factor. *"The portion of inland costs in the total costs of container shipping would range from 40% to 80%. Many shipping lines therefore consider inland logistics as the most vital area still left to cut costs."* [92]. *Inland connectivity in SADC* (pp 57-64) addresses inland transport issues in SADC.
- **Cargo availability and a good market structure.** This implies developing a local cargo base that attracts a critical mass of liner services based on gateway traffic. Critical to a strong local cargo base are efficient strategies for dealing with empty containers.

In addition, SADC ports can focus on the following competitive elements:

- **Low port tariffs.** Transhipment containers have a lower revenue margin because of additional handling costs. SADC port tariffs need to be competitive with transhipment hubs along the Cape and Suez Routes to attract transhipment volumes. According to the Ports Regulator, the tariff for a unitary container vessel at the Port of Durban in 2010 was US $180 000, more than double the global average of US $65 000[93]. Tariffs could well become one of the leading reasons why transhipment traffic is redirected away from SADC to other regions.
- **Availability of ship services at ports.** Currently the scope of ship services is limited at SADC ports.
- **High reliability of port operations and scheduling.** *"…smooth synchronization of deepsea services requires a high schedule integrity"* [94].
- **Draft conditions** that can accommodate increasing vessel size.

Of course, all of these competitive differentiators are moot points if infrastructure constraints and operational capacity simply cannot handle increased business volumes or larger vessels.

88 Notteboom, TE. 2012. Towards a new intermediate hub region in container shipping? Relay and interlining via the Cape route vs. the Suez route. *Journal of Transport Geography*. 22:164-178.

89 Tongzon, JL. 2009. Port choice and freight forwarders. *Transportation Research Part E*. 45:186-195.

90 Tongzon, JL. and Sawant, L. 2007. Port choice in a competitive environment: from the shipping lines' perspective. *Applied Economics*. 39:477-492.

91 Organisation for Economic Co-operation and Development (OECD) and International Transport Forum (ITF). 2008. *Port Competition and Hinterland Connections*. Joint Transport Research Centre. Discussion Paper No. 2008-19. Joint Transport Research Centre, Round Table. 10 -11 April 2008. Paris.

92 Notteboom, TE. and Rodrigue, J. 2005. Port regionalization towards a new phase in port development. *Maritime Policy & Management*. 32(3): 297-313.

93 Development Bank of Southern Africa. 2012. *The State of South Africa's Economic Infrastructure: Opportunities and Challenges 2012*. Development Planning Division: Development Bank of Southern Africa. South Africa.

94 Notteboom, TE. 2012. Towards a new intermediate hub region in container shipping? Relay and interlining via the Cape route vs. the Suez route. *Journal of Transport Geography*. 22:164-178.

Governance issues relating to developing a competitive port region

Notteboom and Rodrigue[95] elaborate on the governance issues relating to port regionalisation. Port authorities in SADC can, and should have a decisive influence in driving solutions to hinterland connectivity issues and efficiency of the interfaces between the ports and inland transportation. The port authorities should strongly consider their role as facilitators and recognise the necessity for cooperation with the carriers, shippers, freight forwarders, labour unions and governments involved in these issues. A hurdle in governance issues is the geographical scope of port authorities in a region which implies that a port authority may not have influence over the very economies it serves and transport networks it uses simply because these are outside its geographic jurisdiction. This is true for SADC where the geographic jurisdiction of political governments further complicates port regionalisation. Port development perspectives formed by political agendas and local rationality can be severely myopic, inhibiting successful port regionalisation strategies. One way of crossing this hurdle is through the formation of multilateral bodies, such as the Maputo Logistics Corridor Initiative that crosses political and organisational boundaries to improve logistics efficiency for the entire region.

Valid concerns, however, exist for the development of a port region. Over-optimism regarding the potential for market development and the local benefits of port development could result in a 'logistics hub in every province' mentality which leads to "*overcapacity situations, redundancies and cutthroat competition*"[95]. The long lead-time and slow start of projects could result in costly and unsynchronised development. Finally, the distribution of costs and benefits throughout the region is a concern and should be addressed frankly and upfront as some free riders always seem to be benefitting from the considerable investment of others.

CONCLUSION

The SADC region has much to gain by becoming a world-class transhipment community. Not only would this improve the efficiency of inland supply chains and drive down the cost of business, but it would create additional revenues from handling transhipped cargo that was merely passing by the Cape Route. In comparison to established transhipment communities in South East Asia, the Caribbean and the Mediterranean, SADC needs to establish better intraregional connectivity through more frequent and reliable feeder services and needs to improve its inland freight transport connectivity and the strength of its regional cargo base.

95 Notteboom, TE. and Rodrigue, J. 2005. Port regionalization towards a new phase in port development. *Maritime Policy & Management*. 32(3): 297-313.

Ports in the region can increase their competitiveness for transhipment volumes by offering a larger scope of ship services; lowering tariffs, especially for transhipment; increasing operational reliability and accommodating larger vessels. However, these competitive differentiators will only be effective if the port infrastructure and operational efficiency can actually handle increased business volumes and larger vessels. Whether SADC will succeed in elevating itself as a world-class transhipment community hinges on the ability of governments and port authorities to work across political boundaries and with private industry stakeholders in finding solutions to hinterland connectivity issues and improving the efficiency of the interface between the ports and inland transportation.

INLAND CONNECTIVITY IN SADC

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De Jonge, Gerrie (IMPERIAL Logistics),
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Laubscher, Cyril (IMPERIAL Logistics)

INTRODUCTION

Immense potential and business opportunities exist in southern Africa in terms of natural resources, low-cost labour and a rapidly growing consumer market. While growth prospects in Europe and the USA are meagre at best, big business turns its attention to developing regions such as southern Africa for its next growth frontier. A case in point would be the increase in foreign direct investment in sub-Saharan Africa from US $29 billion in 2010 to US $37 billion in 2011[96].

According to the latest Barloworld **supply**chain**foresight** 2013 survey[97], 75% of South African business executives indicated that *Expanding into emerging markets* is one of their top five strategic business objectives with the Southern African Development Community (SADC) (38%), China (28%), India (13%) and Brazil (11%) being the most favoured destinations. Investigating the Africa Question, the 2012 survey indicated that the top three constraints to doing business in Africa are: *Availability of reliable service providers and partners* (77%); *Lack of adequate infrastructure* (74.9%); and *Transit times and reliability* (74.6%)[98].

SADC is bedevilled by its poor regional connectivity. Four of the 15 SADC member states are landlocked (Botswana, Malawi, Zambia and Zimbabwe), while the Katanga province in the Democratic Republic of Congo has extremely limited access to the port of Matadi due to poor infrastructure. Limited inland connectivity isolates these economies from world markets and drives up their logistics costs. Logistics costs as a percentage of GDP in Africa is estimated at 30% – extremely high when compared to South Africa (12.8%) and top performers globally (7.5%). SADC is addressing this phenomenon through the development of dedicated, multi-national trade and logistics corridors, which aim to link economic centres, consumer markets and ports across the region. This article discusses the regional corridors and points out the most pressing constraints that stifle logistics and trade across SADC.

96 Albert, A. and Jali, P. *Accessing Africa: What gate, which way?* eThekwini Municipality. Economic Development and Investment Promotion Unit: Policy, Strategy, Information & Research.

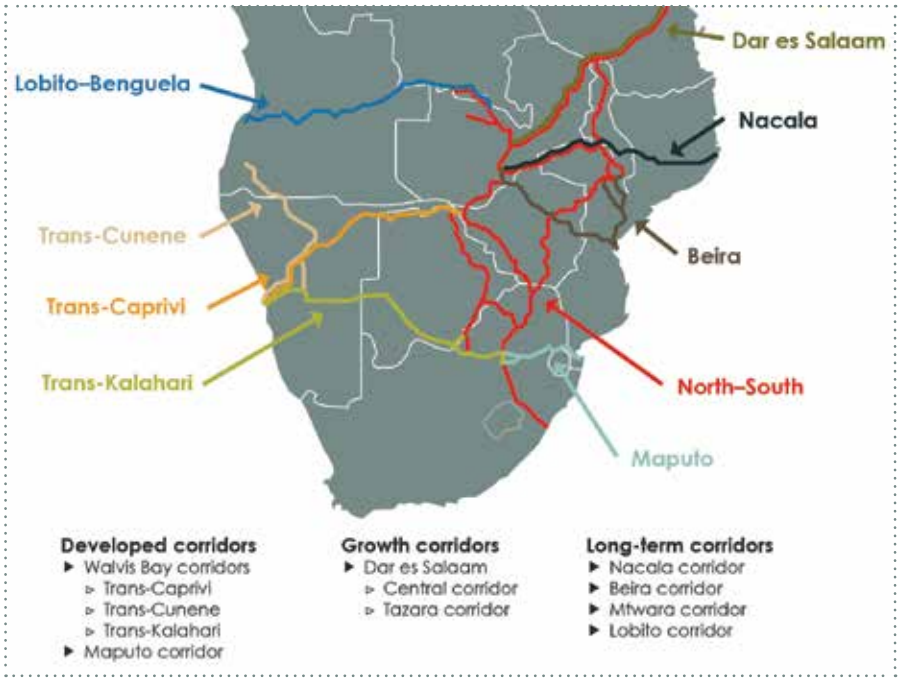
97 Barloworld Logistics. 2013. *2013* supply*chain*foresight*: serial innovation, smart partnerships and sustainable advantages.* Available: www.supplychainforesight.co.za.

98 Barloworld Logistics. 2012. *2012* supply*chain*foresight*: South Africa Inc.: Growth, Competitiveness and the Africa Question*. Available: www.supplychainforesight.co.za.

REGIONAL CORRIDORS

Historically, the North–South corridor (see **Figure 30**) has been the main access route for imported traffic travelling through South Africa to SADC. The other corridors shown in **Figure 30** are either classified as developed corridors, growth corridors or long-term corridors.

Figure 30: Regional inland corridors in SADC



Developed corridors were established based on on-going supply chain activity along the inland routes. Based on current economic activity and expected future growth scenarios, rapid growth in volumes is not necessarily expected on these corridors unless significant market opportunities develop. Nonetheless, trade on these corridors is stable and consistent. **Figure 31 and Figure 32** outline the economic potential of the Trans-Caprivi and Maputo corridors, respectively.

The Maputo corridor (**Figure 32**) continues to face the substantial growth challenge that it is difficult to divert cargo from the Port of Durban to the Port of Maputo, especially with a limited cargo base in Mozambique and prevailing draft constraints.

Figure 31: Economic potential of the Trans-Caprivi corridor

Trans-Caprivi corridor (Ndola Lumbumbashi corridor)

Potential hub-transit corridor for Angola, Zambia, the southern Democratic Republic of Congo and Zimbabwe

Economic characteristics	Corridor catchment area: ▸ Population 50 million ▸ GDP of US $120 billion ▸ Expected growth of 6-8%
Transport sector growth potential	▸ Plans to expand to 500 000 TEU capacity ▸ Sector growth of 12-15% expected if capacity plans are realised ▸ Rail infrastructure is critical for future growth
Opportunity and investments	▸ Regional intermodal and transit hub development are critical ▸ Planning for deepening Port of Walvis Bay up to 14.5 m draft underway
Risk profile	▸ Moderate risk with focus on growing container and break bulk volumes ▸ Investment confidence high due to initiatives by the Walvis Bay Corridor Group

Figure 32: Economic potential of the Maputo corridor

Maputo corridor

Well-established road and rail corridor

Economic characteristics	Corridor catchment area: ▸ Population 50 million ▸ GDP of US $120 billion ▸ Expected growth of 4-5%
Transport sector growth potential	▸ Plans to expand to 300 000 TEU capacity ▸ Expected sector growth of 8-10% ▸ Rail and road links are good
Opportunity and investments	▸ Urgent need for a private container terminal at the Port of Maputo ▸ Investment opportunities limited to rail (not road): especially in shifting cargo from road to rail
Risk profile	▸ Risk low to moderate ▸ Investment confidence moderate due to low volumes

The growth corridors in Tanzania have the potential for significant growth because of expected future market conditions and economic scenarios. **Figure 33** outlines the economic potential of these corridors.

Figure 33: Economic potential of the Dar es Salaam corridors

Dar es Salaam corridors

Key road and rail transit corridor to Zambia, the Democratic Republic of Congo and Malawi from Tanzania

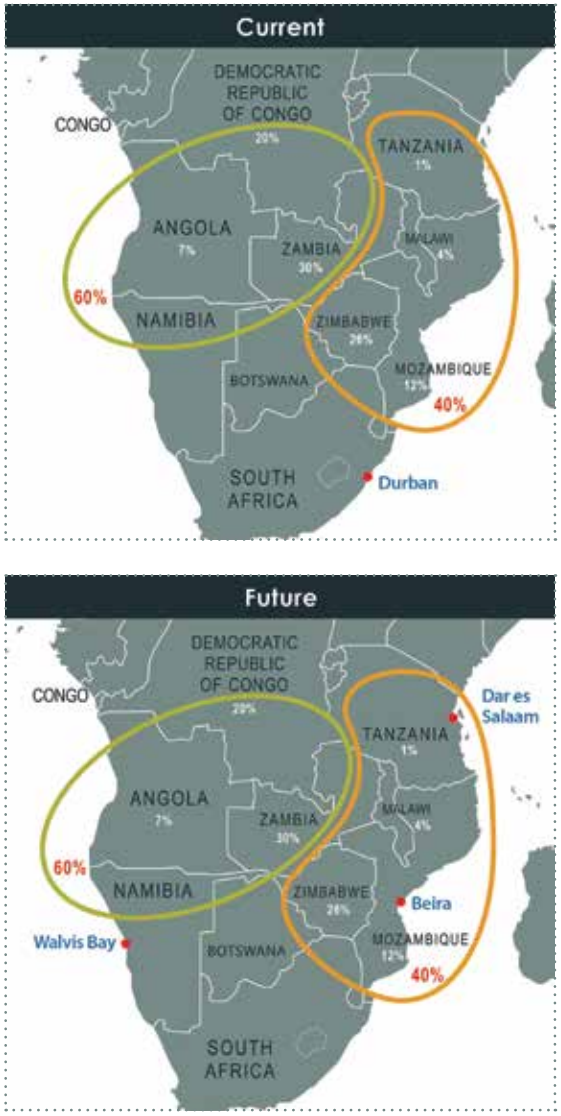
Economic characteristics	Corridor catchment area: ▸ Population 110 million ▸ GDP of US $40 billion ▸ Expected growth of 6-8%
Transport sector growth potential	▸ Plans to expand to 1 million TEU capacity ▸ Expected sector growth of more than 8-10% ▸ Intermodal traffic is key in reaching growth goals
Opportunity and investments	▸ Great opportunity for intermodal hubs and transit barge operations at Kapiri and Lake Victoria and Lake Tanganyika
Risk profile	▸ Risk moderate to high due to low volumes and poor infrastructure ▸ Questionable investment confidence

The long-term corridors are expected to transform into well-established rail and road corridors in response to the rapid development of mining and related activities in the SADC region.

CARGO FLOWS IN SADC

Approximately 60% of cargo volumes imported through South Africa to SADC is destined for Zambia, the Democratic Republic of Congo and Angola, while the remaining 40% is destined for Zimbabwe, Mozambique and Malawi (**Figure 34**). It is estimated that 48% of these volumes are transported by road from the Port of Durban while 52% is transhipped via coastal shipping.

Figure 34: Cargo volumes imported through Durban to SADC should ideally be attracted directly to regional ports



A major cargo imbalance exists in the region as negligible cargo volumes return from SADC through South Africa for export. This cargo imbalance and the additional transport burden due to using the Port of Durban as the primary gateway drive up

the cost of logistics.

Attracting the international traffic directly to the regional ports of Walvis Bay, Beira and Dar es Salaam seems like the best solution, but this requires that adequate infrastructure be provided at those ports and that the regional corridors are developed as expected.

REGIONAL CONSTRAINTS TO CONNECTIVITY AND COMPETITIVENESS

There are, however, a number of ubiquitous issues that SADC governments need to address sternly before the envisioned strategic initiatives to build regional connectivity can be realised. First and foremost, governments must create an environment conducive to lucrative public-private partnerships (PPPs) that would attract the private sector. Unfortunately, the necessary collaborative platforms and frameworks required to fast-track open discussion and negotiation between public and private sectors are lacking. Globally competitive and transparent trade facilitation, procedures for cross-border trade and corridor development plans need to be underpinned by government commitment and investment.

Correcting the cargo imbalance in the region and having balanced two-way traffic are also essential in driving down the considerable additional logistics costs incurred through 'empty trips'. However, correcting this imbalance is not only a transport issue but an underlying trade and development one.

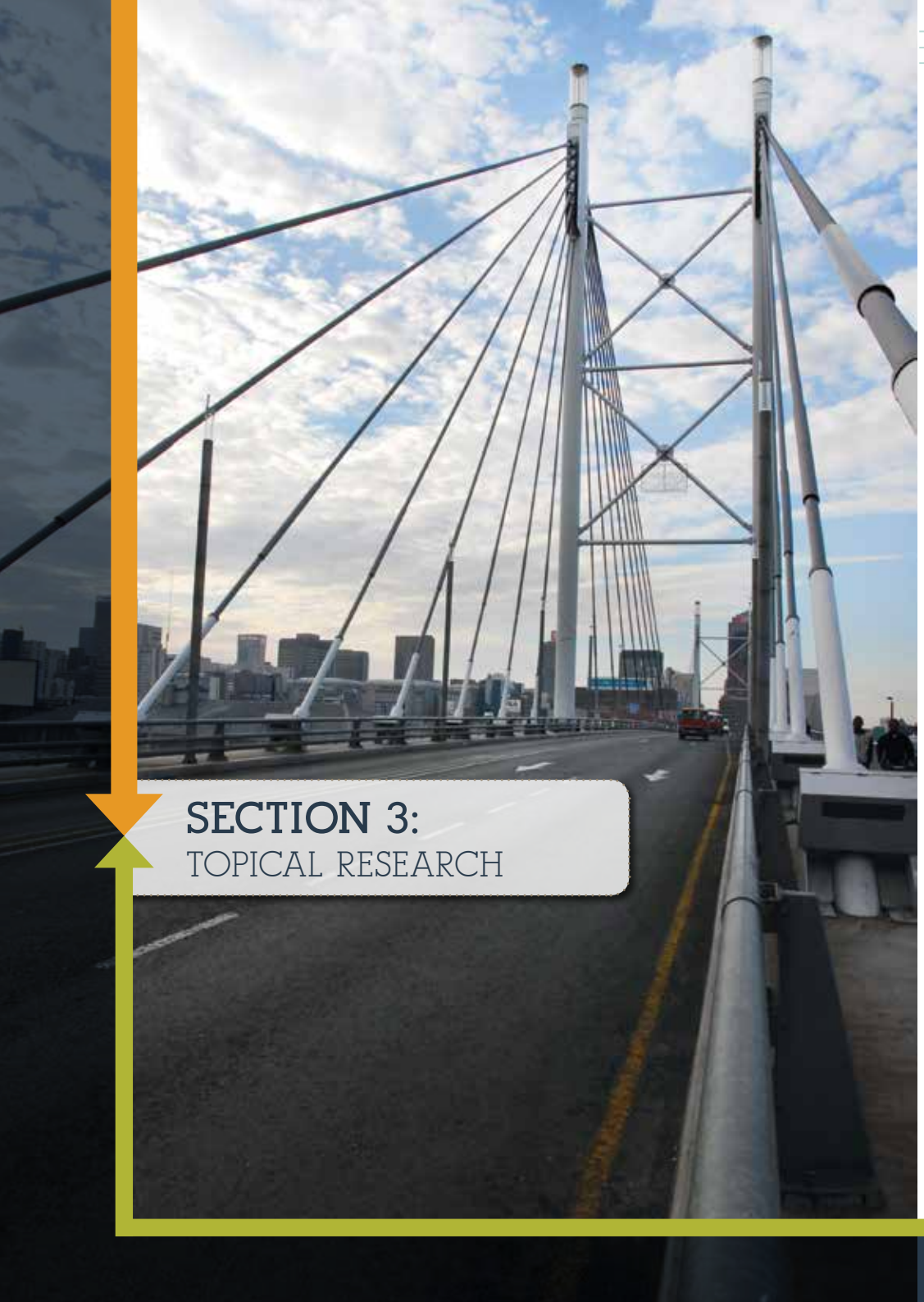
Cross-border movements in SADC are hampered by cumbersome and inefficient paperwork and delays at border posts. Trade procedures and paperwork are vastly duplicative with a lack of alignment between governments and trading agencies. It has been recorded that in some cross-border movements up to 25 different parties are involved, requiring 40 different documents. The design of information systems is cumbersome, often having redundant data elements.

Human error in entering forms has resulted in the re-entering of data more than 80% of the time at subsequent border posts. Border posts in SADC suffer from a dire lack of human resources required to execute current trade procedures. The concept of the one-stop border post has been implemented at some border posts in the region with varying degrees of success, but by-and-large delays at border posts are still one of the key cost drivers in logistics costs and present a road-block to trade facilitation.

More generally, the integrity and strength of political and regulatory institutions are still questionable in SADC and corruption erodes competitiveness and broad-based socio-economic development. A lack of socio-economic development is clearly apparent in the high levels of unemployment, poor education systems, gender discrimination, abysmal health care and the extreme reliance of the region on donor funding. A shortage of skilled human resources and deficient infrastructure further exacerbates the region's logistics challenges.

CONCLUSION

SADC holds immense potential for business development and foreign direct investment with many developed countries chomping at the bit to establish their markets in southern Africa. The region aims to redress a legacy of extremely poor connectivity through the development of strategic trade and logistics corridors that link economic centres, countries and ports. Significant port expansion projects are also on the cards to enable more direct shipping to destination markets in SADC. The strategic initiatives are heartening and, if realised, would transform the region into a very attractive, globally competitive economic region. However, these initiatives cannot succeed without the governments of the member states getting serious about enabling lucrative PPPs and addressing stifling operational inefficiencies in cross-border trade.



SECTION 3:
TOPICAL RESEARCH

TRANSPORT INFRASTRUCTURE AND PLANNING

Ittmann, Hans W (HWI Consulting)

INTRODUCTION

There is general agreement that infrastructure is the cornerstone of a stable and productive society. The correct approach to constructing and maintaining infrastructure, including transport infrastructure, is essential to create a strong and competitive economy. Infrastructure not only presents huge challenges, it also provides opportunities for both the public and private sectors. This article focuses on road, rail, port, pipeline, and airport infrastructure within South Africa, all of which are essential and very critical for supply chain management and logistics services within the country. In addition, the planning and construction of infrastructure, which is a critical but more complex aspect, are also discussed briefly. Planning of infrastructure is much more challenging since it involves a high degree of uncertainty. Infrastructure is typically built to last 20 to 30 years and in the case of rail infrastructure, even longer. Decisions regarding where to construct new infrastructure and where to enhance capacity are dependent on forecasting an uncertain future while the capital expenditure required for this kind of infrastructure is enormous, leaving very little room for error.

IMPORTANCE OF TRANSPORT INFRASTRUCTURE AND PLANNING

Infrastructure – transport infrastructure in particular – is critical for the economic development and growth of a country. The National Development Plan, now adopted by the South African government as its development plan for the future, clearly states the tremendous challenge the country faces in this regard:

"South Africa has missed a generation of capital investment in roads, rail, ports, electricity, water, sanitation, public transport and housing"[99].

The situation in South Africa is not unique; across the world, inadequate or poorly performing infrastructure presents major economic challenges. All of this comes at a time when most governments are heavily indebted while their scarce resources cannot meet all the needs. McKinsey Global Insight[100] estimates that US $57 trillion is required to invest in infrastructure between now and 2030 worldwide, just to keep up with projected global Gross Domestic Product (GDP) growth. The infrastructure referred to includes transport (road, rail, ports and airports), water, energy, and telecommunications.

Kessides[101] provides comprehensive evidence to illustrate the contribution of infrastructure to economic development. Recent research on this aspect by the World Bank[102] shows that for every 10% increase in infrastructure provision, there is an increase of approximately 1% in output over the long term. On the other hand, improved infrastructure *quality* accounted for 30% of growth attributed to infrastructure in developing countries. Clearly the impact of infrastructure on growth varies from country to country. For a country such as Egypt, Loayza and Odawara[103] found that the country has experienced remarkable progress in the provision of infrastructure in all areas, including transportation. They also suggest that an increase in infrastructure expenditure from 5-6% of GDP would raise the annual per capita GDP rate by about 0.5 percentage points within a decade and by 1 percentage point by the third decade. In their study of infrastructure in Latin-America, Calderón and Servén[104] conducted an empirical evaluation of the potential contribution of infrastructure to growth in the region. They show that there is *"robust evidence that infrastructure development – measured by an increased volume of infrastructure stocks and an improved quality of infrastructure services – has a positive impact on long-run growth"*.

Given the huge capital investment required internationally for transport infrastructure, new and innovative ways to address the problem are being developed and

99 National Planning Commission 2011. Diagnostic Overview. Available: http://www.npconline.co.za/pebble.asp?relid=33

100 McKinsey Global Insight. 2013. *Infrastructure productivity: How to save $1 trillion a year*. January 2013.

101 Kessides, C. 1993. *The contributions of infrastructure to economic development: A review of experience and policy implications*. The World Bank. Washington, D.C.

102 World Bank. 2013. *Can infrastructure investments generate growth?* The World Bank. Washington, D.C. Available: http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTINFRA/0,,contentMDK:23154473~pagePK:64168445~piPK:64168309~theSitePK:8430730,00.html

103 Loayza, N. and Odawara,R. 2010. *Infrastructure and Economic Growth in Egypt.* Policy Research Working Paper 5177. The World Bank. Washington, D.C.

104 Calderón, C. and Servén, L. 2010. *Infrastructure in Latin America*. Policy Research Working Paper 5317. The World Bank. Washington, D.C.

implemented, this also applies to planning processes. In Canada, the National Transportation Policy[105] is based on two key innovative principles namely:

1. Maximising the capacity of the transport network, this is achieved by:
   - Improving the operations and efficiency of the existing system;
   - Strategically expanding the capacity of the system by exploring new models of funding;
   - Ensuring the availability of a skilled labour pool to meet the industry's needs;
   - Ensuring statutory, regulatory and institutional regimes to support a strong system; and
   - Proactively identifying and addressing emerging transportation needs.
2. Earning public support through socially responsible behaviour to minimise environmental impact, to address safety and also to engage the public in education.

McKinsey[106] proposes three broad approaches to save up to US $1 trillion per annum on worldwide infrastructure expenditure through:

- Optimising project portfolios by avoiding investments in projects that neither address clearly defined needs nor deliver sufficient benefits;
- Streamlining delivery through speeding up the approval processes. This is achieved by investing heavily in the early stages of project planning and design, and structuring contracts to encourage time and cost savings; and
- Making the most of existing infrastructure through mechanisms such as boosting asset utilisation and optimising maintenance planning.

It is clear that governments have a crucial role to play in implementing these approaches to optimise infrastructure investment. A recurring theme is the increased participation of the private sector in the planning and provision of infrastructure.

STRATEGIC PLANNING PROCESS

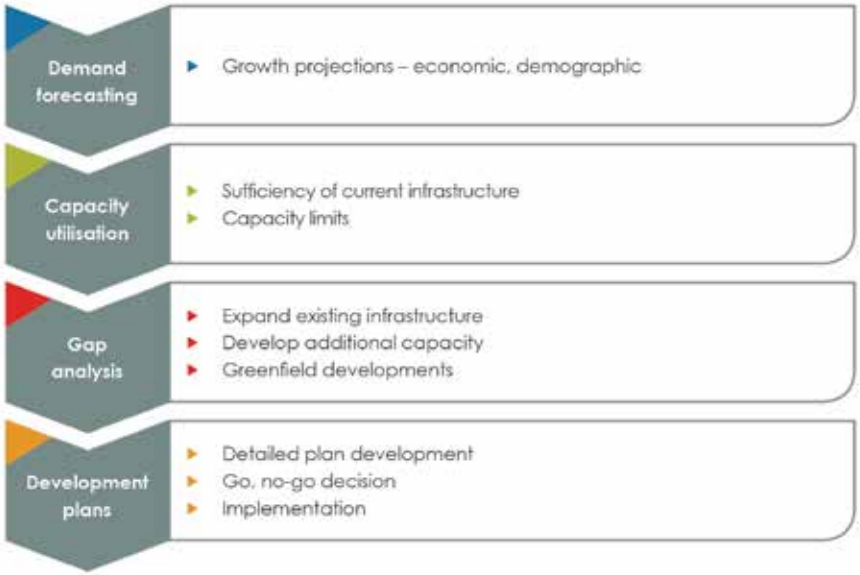
The objective of establishing transport infrastructure is to provide the necessary capacity before the demand for transport is realised. Therefore development plans and long-term planning are typified by, among others, forecasting an uncertain future, long lead times and huge investments. The life-span of the infrastructure is also long term, in most cases

105 Framework for the National Transportation Policy 2008. Canada. Available: http://www.westac.com/pdfs/FrameworkNTP.pdf

106 McKinsey Global Insight 2013. *Infrastructure productivity: How to save $1 trillion a year*. January 2013.

this is typically 20-30 years whereas for rail it is much longer. Before detailed planning can commence, a decision must be made regarding which portfolio of potential future growth scenarios would materialise. This is no trivial task. Once decided, the planning process indicated in **Figure 35** should be followed. This process needs to be re-evaluated on an almost annual basis and adapted as required. The aim of developing transport infrastructure ahead of demand is, in essence, a response to economic and demographic activity. For example, if there is very clear evidence that the demand for a commodity, exported by rail, is going to grow over time, it makes sense to increase the capacity on the rail line for it to meet the increased demand when it materialises. Another approach, which has also been used in South Africa, is to encourage and stimulate economic development through the establishment of infrastructure. An example is the Port of Ngqura which was built with the clear intention of stimulating economic development in that region. Road and rail infrastructure is now also in place and economic activity is starting to realise.

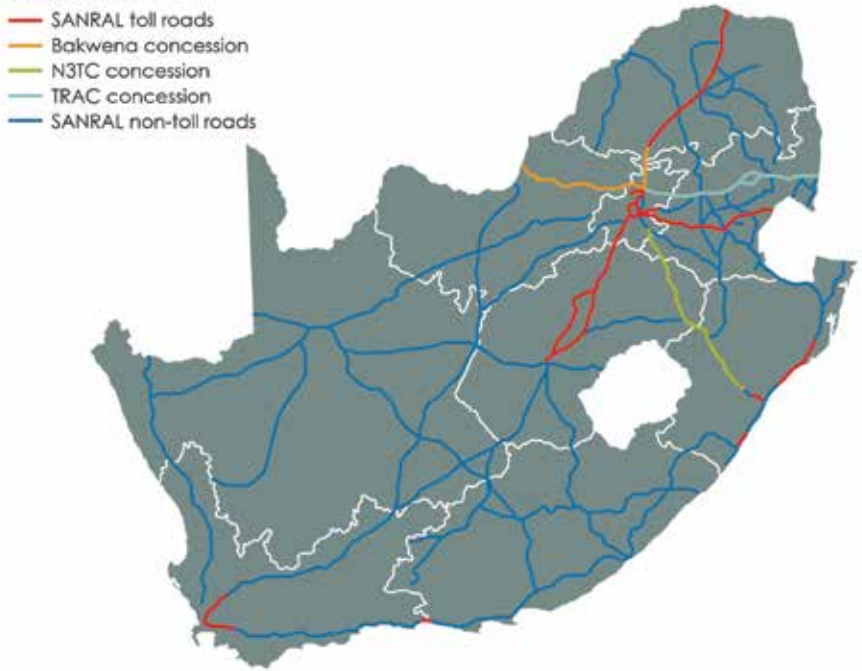
Figure 35: Strategic planning process



THE STATUS QUO OF TRANSPORT INFRASTRUCTURE IN SOUTH AFRICA

The road and rail infrastructure in South Africa stretches across the entire country and most areas are generally fairly well-connected, except specific remote areas. Roads in the country fall under the jurisdiction of three spheres of government, namely, national, provincial and municipal. The total proclaimed roads in the country amount to approximately 535 000 km in length, of which 366 872 km are non-urban roads and 168 000 km are urban roads[107]. Of the non-urban roads, 32 340 km fall under the management of the South African National Road Agency Limited (SANRAL) – see the map in **Figure 36** – while just over 300 000 km of the proclaimed roads are gravel roads.

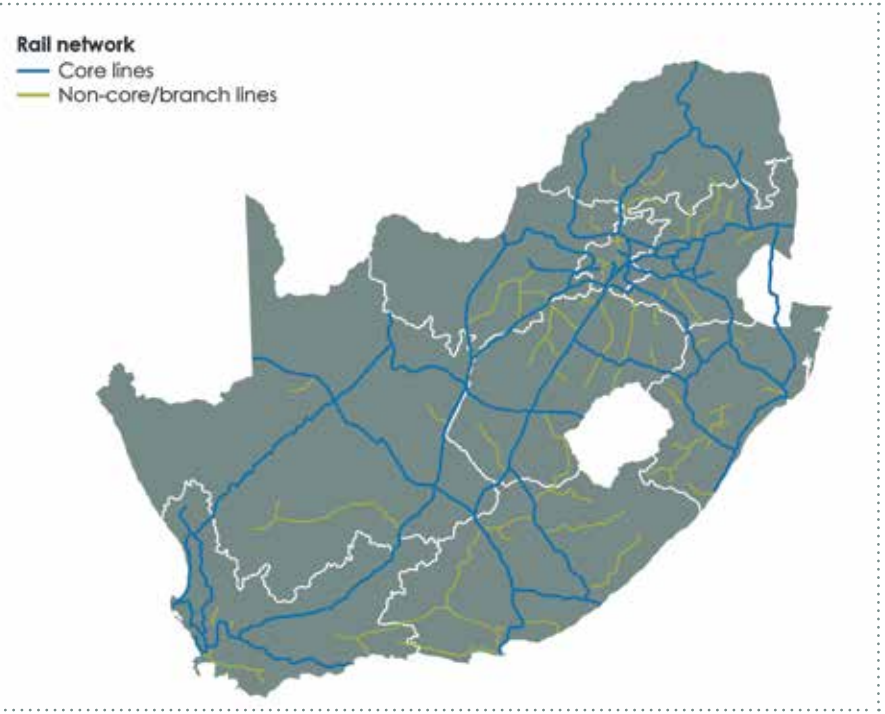
Figure 36: National roads managed by SANRAL[108]



107 SANRAL, 2013. *SANRAL network*. Available: http://www.nra.co.za/live/content.php?Category_ID=46

The South African rail network consists of 30 400 km of track[108] with an actual route distance of about 20 079 km, providing excellent coverage of most of South Africa. Of the route network 12 801 km can be classified as the 'core network', or the main corridors, with about 7 278 km of the route lines classified as 'branch lines'. The branch lines were built primarily to service communities in remote areas and activities not directly on the main corridors, but the majority of these are currently out of commission. **Figure 37** presents the rail network of the country.

Figure 37: Rail network of South Africa



The port infrastructure of South Africa consists of eight reasonably well-developed commercial ports along the coastline of South Africa. These are by far the most productive and modern port facilities on the African continent. As part of the preparations for the Soccer World Cup in 2010, the main airports in the country were upgraded substantially and the current international airports are world-class. Pipeline infrastructure consists of a limited number of pipelines, mainly delivering refined products from Durban to Gauteng while there is a gas pipeline stretching from Mozambique to Secunda.

108 TRANSNET 2012. *Long Term Planning Framework (LTPF)* 2012. Available: http://www.transnet.net/BusinessWithUs/LTPF%202012/3.%20Rail%20Development%20Plans.pdf

The South African Institution of Civil Engineering (SAICE) publishes a report card on the state of infrastructure in the country[109]. The report card focuses on "*drawing the attention of government, and of the public at large, to the importance of maintenance, and to factors underlying the state of repair of infrastructure*"[110] in the country. The latest report card, published in 2011, highlights the disparity in road conditions depending on the government authority responsible for its upkeep. The SANRAL-managed roads are in a good condition while provincial roads are in general not well maintained and thus in a worsening, poor condition (see *The potential effects of deteriorating road conditions in South Africa*, pp 29-38). On the rail side, heavy-haul freight lines are well maintained and general freight lines show a slight improvement, while branch networks are in a state of disrepair. Ports show steady improvement and are reported to be fairly well-maintained. Lastly, the Airports Company of South Africa (ACSA) provides world-class aviation infrastructure at most of the airports under its jurisdiction.

A further aspect that affects road and rail infrastructure in particular is the imbalance of freight on road and rail. Significant volumes of freight currently transported on road are ideally suited for rail, especially along the main corridors. Freight needs to be shifted from road to rail, in particular, future freight growth on the main corridors should be absorbed by rail. The following are convincing reasons for shifting freight from road to rail[111]:

- It would drastically reduce road congestion by taking freight vehicles off the road.
- It will reduce carbon emissions as rail is more environmentally efficient. Rail haulage is more fuel efficient than road haulage and produces less than a 10th of the nitrogen oxide and fine particulates produced by road haulage per tonne carried.
- The number of road accidents caused by freight vehicles will be reduced with less freight vehicles on the road. This will reduce both the number of lives lost and injuries sustained.

If the current situation prevails the main road corridors will continue to take enormous strain in future. The question remains whether South African transport infrastructure will meet transport demand going forward. It is critical that the adopted plans be implemented and that a culture of on-going maintenance is instilled within all the responsible authorities.

109 South African Institution of Civil Engineering (SAICE). 2011. *The SAICE infrastructure Report Card for South Africa: 2011*. SAICE. Midrand, South Africa.

110 Amod, S., Wall, K., and Rust, C. 2012. SAICE report cards on the state of infrastructure. *Management, Procurement and Law*. Vol. 165: 119.

111 NetworkRail. 2010. *The Value and Importance of Freight.* July 2010.

DEVELOPMENT PLANS

The Department of Transport published a White Paper on National Transport Policy in 1996 with the vision of integrating transport operations and infrastructure for both freight and passengers while meeting specific economic and social needs. To give impetus to this vision, the Moving South Africa Strategy (MSA) was developed in 1998. The MSA was not implemented mainly because projected freight volumes grew much faster than anticipated. A new strategy, the National Freight Logistics Strategy (NFLS)[112] was developed in 2005, focusing much more on regulatory and institutional reform to ensure a more efficient freight system. Subsequent to the NFLS, the National Transport Master Plan (NATMAP 2050) has been developed to establish a "*dynamic, long-term and sustainable land use/multi-modal transportation systems framework*"[113]; the vision of this plan being: "*continuously upgrading infrastructure and services ahead of demand*". The first two plans had limited impact and it is too early to judge what the outcome will be of NATMAP 2050.

CURRENT TRANSPORT INFRASTRUCTURE INVESTMENT PROCESS IN SOUTH AFRICA

The South African government is committed to addressing the infrastructure requirements in the country and has established several institutions to strengthen state capacity for infrastructure delivery[114]. In this regard a Presidential Infrastructure Coordinating Commission (PICC), headed by the President, has been established to coordinate and oversee the implementation of strategic infrastructure projects (SIPs) that stimulate social and economic growth. Eighteen SIPs have been identified and approved to support economic development and address service delivery in the poorest provinces[115]. Seven SIPs include a sizeable transport infrastructure component, including:

- SIP 1: Unlocking the northern mineral belt with Waterberg as the catalyst;
- SIP 2: Durban–Free State–Gauteng logistics and industrial corridor;
- SIP 3: South eastern node and corridor development;
- SIP 4: Unlocking economic opportunities in North West;
- SIP 5: Saldanha–Northern Cape development corridor;
- SIP 11: Agri-logistics and rural infrastructure; and
- SIP 17: Regional integration for African cooperation and development.

112 Department of Transport. 2005. *National Freight Logistics Strategy*. Available: http://www.portsregulator.org/images/documents/National_Freight_Logistics_Strategy.pdf

113 Dyodo, S. 2011. *National Transport Master Plan (NATMAP 2050)*. 13th African Renaissance Conference. Durban. Available: http://ebandla.co.za/uploads/SibuleleDyodo.pdf

114 Development Bank of Southern Africa. 2012. *The State of South Africa's Economic Infrastructure: Opportunities and Challenges 2012*. Development Planning Division: Development Bank of Southern Africa. South Africa.

115 Presidential Infrastructure Coordinating Commission (PICC). 2012. *A summary of the Infrastructure Plan*. Presidential Planning Commission Coordinating Commission. Provincial and Local Government Conference. 13 April 2012. Available: www.info.gov.za/speeches/docs/2012/picc-presentation_120413.pdf

The individual SIPs are managed by a state-owned enterprise or state agency[116]. There is no indication of direct private sector involvement in these SIPs. The Minister of Economic Development did, however, indicate that the private sector was requested to provide inputs regarding these infrastructure plans. Funding for infrastructure will remain a challenge but government is unrealistic if it expects to satisfy all the infrastructure development needs itself. In order to address this challenge, it is necessary to attract new investors, mainly from the private sector. More involvement of the private sector in the development and execution of infrastructure plans is a necessity.

The funds that are allocated for all infrastructure developments, including transport, are substantial. For the period 2012/2013–2014/2015, public-sector funding is estimated at a total of R844.5 billion. In addition, the Market Demand Strategy[117] of Transnet entails an investment in rail and port infrastructure of R300 billion over a seven-year period that started in 2012. At a recent post-State of the Nation Address media briefing[118], Economic Development Minister Patel indicated that the PICC is monitoring progress on these SIP projects on a quarterly basis. Speeding up government spending remains a challenge but efforts are underway to streamline processes to address this. The Minister indicated that government has introduced new practices and processes in legislation to address these bottlenecks (for example the current bitumen shortage) and to ensure government acts in a more integrated and coordinated manner.

CONCLUSION

No economy can operate efficiently without sufficient and well-maintained transport infrastructure since this is a necessary requirement for competitive supply chains. Although the National Development Plan stresses the importance of infrastructure development, the need for a 'National Logistics Infrastructure Plan' remains. The importance of logistics and supply chain management for a thriving, growing and competitive economy is essential. The various players all need to jointly develop such a plan, and cooperate and collaborate in making this happen in the interest of the country. Private sector involvement in infrastructure development, specifically logistics infrastructure, is becoming non-negotiable. This fact is recognised worldwide as governments find it increasingly difficult to meet all the needs of their respective countries.

116 Maake, M. 2012. *Infrastructure projects will 'not come cheap'*, Business Day. 21 October 2012. Available: http://www.bdlive.co.za/economy/2012/10/21/infrastructure-projects-will-not-come-cheap

117 Transnet. 2012. *Market Demand Strategy.* Available: http://www.transnet.net/PressOffice/Pages/Market-Demand-Strategy.aspx

118 Esterhuizen, I. 2013. *Speeding up State Infrastructure spending a challenge.* Engineering News. 7 March 2013.

In South Africa many good plans have been developed but a lack of implementation, mainly because of the lack of commitment and political will to ensure implementation, rendered these to remain only good plans. The country cannot afford this any longer. Strong political commitment goes hand-in-hand with the availability of funds for these endeavours, requiring different and innovative funding models that include the private sector.

Finally, a concerted effort is essential to shifting freight from road to rail. Road will always remain the preferred mode of getting freight from point A to point B the fastest. However, rail presents a relatively fast, greener, safer and more efficient way of transporting freight over long distances along the main corridors and should become the mode of choice for such freight movements.

SKILLS SHORTAGES AND REQUIREMENTS IN THE LOGISTICS INDUSTRY IN SOUTH AFRICA

Luke, Rose and Heyns, Gert J (University of Johannesburg)

INTRODUCTION

According to the World Economic Forum[119] "*the logistics and supply chain sector underpins the entire global economy.*" Not only are substantial logistics infrastructure investments needed, but the availability of qualified, skilled and experienced employees is essential to ensure that the global supply chain industry can continue to deliver on global economic demands.

The shortage of skills in South Africa is frequently cited as one of the key features inhibiting growth in the country's economy. The lack of availability of a skilled workforce is viewed as one of the key constraints to the expansion of business operations in South Africa. South Africa's skills shortage poses a substantial limitation on the country's long-term economic growth potential. Due to a lack of the necessary skills, it is increasingly difficult to develop sustainable economic opportunities productively.

The skills shortage appears to be a global problem, both in developed and developing markets. It is estimated that 39% of businesses around the world are struggling to recruit the right people, and as many as 64% cited a lack of technical skills as the primary problem. A lack of skilled workers is the key issue constraining business growth in higher-growth emerging economies. Nearly two in five businesses (37%) in the BRIC (Brazil, Russia, India and China) economies believe an inability to get the right workers will dampen growth in 2013. Businesses in the emerging economies of South East Asia (42%), Asia Pacific (excl Japan, 36%) and Latin America (35%) are dealing with

119 World Economic Forum. 2012. *Outlook on the Logistics & Supply Chain Industry 2012.* Geneva, Switzerland.

similar talent shortages[120]. Europe reports that, although high levels of unemployment are experienced, skills shortages and misalignments are also evident, with certain regions or sectors lacking employees who fit their needs[121]. Businesses in Latin America and Asia Pacific cite a lack of creativity and skilled human resources (62%) as their top two workforce-related challenges. Similar challenges exist in North America[122,123].

Skills shortages vary from country to country but it appears that all countries do not produce the skills that their economies require. Business environments are becoming more multifaceted and employers therefore require far more specific skills. As long as the resulting mismatch between the supply and demand of skills continues to exist, economies will struggle to achieve the growth and development that they require in today's global environment.

As the global talent crunch deepens, many countries will find it difficult to hold onto their available human resources. Developed countries such as the United States of America, the United Kingdom and Australia, with known skills shortages in particular areas, have adjusted their immigration policies to ensure that not only is immigration of persons with the relevant skills allowed, but encouraged. The implication for developing countries such as South Africa is that it is increasingly difficult to retain our available skills, guaranteeing that the well-documented 'brain drain' continues unabated.

One of the most problematic factors for doing business in South Africa is a workforce without the adequate education. A basic requirement for global competitiveness is primary education, where South Africa is ranked 132nd out of 144 countries. An efficiency enhancer is higher education and training, where South Africa is ranked as 84th of 144 countries[124]. In terms of logistics performance, South Africa is currently ranked as number 23 in the world, however the ability to perform more effectively is largely hampered by a lack of logistics competence[125].

This clearly indicates that skills are an issue within the country, and logistics skills in particular are hampering the country's ability to trade both within the region as well as with other countries and regions. *"Africa's share of world trade is tiny–only 3% in 2009, according to the United Nations Conference on Trade and Development. Intra-African trade made up only 10% of total African trade. This stands in stark contrast to 22% between developing countries in South America, and 50% between those in Asia."*[126] It thus becomes critical to identify the logistics skills requirements in South Africa, so that these acute shortages can be addressed to the benefit of trade in and with South Africa and the Southern African Development Community (SADC).

The supply chain skills shortage is viewed as one of the top five constraints to South African supply chains and the single biggest constraint of competitiveness[127]. Even though unemployment in South Africa remains high, employers are finding it difficult to find the right people for vacant positions. The South African economy therefore needs to be able to identify the relevant skills shortages and apply urgent and relevant interventions to resolve a situation that has now become a crisis.

RESEARCH OVERVIEW

To ascertain the trends and statistics with regard to the current logistics skills gaps in South Africa, two surveys were conducted in 2011 and 2012[128]. Based on similar comparative studies and further focus group analysis, a set of 38 skills were identified, which were then clustered into six skills groups, namely *General management*; *Behavioural/Interpersonal skills*; *Logistics awareness*; *Logistics analytical*; *Logistics information technology (IT)*; and *Environmental awareness*. The respondents were requested to rate the perceived importance of the selected skills items typically required by managers in logistics and supply chain organisations.

The majority of the respondents were from the manufacturing and the transport, storage and communications sector, collectively representing 68.2% and 66.5% for 2011 and 2012, respectively. Just over 78% of the respondents were middle and senior managers, indicating that the respondents can be viewed as decision-makers within their respective organisations. The average years of work experience of all respondents in both surveys were more than 16 years, with the average experience in the area of logistics and supply chain management being over 10 years. More than 92% of the respondents held tertiary qualifications.

120 Grant Thornton Business International Report. 2013. *Global economy in 2013: uncertainty weighing on growth.*

121 European Commission. 2013. *Communication from the Commission: Annual Growth Survey 2013.*

122 Global Intelligence Alliance. 2011. *North American manufacturers concerned about skills shortage and government over-regulation.*

123 Global Intelligence Alliance. 2012. *Business Perspectives on Emerging Markets 2012-2017.*

124 World Economic Forum. 2012. *The Global Competitiveness Report 2012/2013.* Insight Report. Geneva, Switzerland.

125 Arvis, JF., Mustra, MA., Ojala, L. Shepherd, B., and Saslavsky, D. 2012. *Connecting to Compete: Trade Logistics in the Global Economy: The Logistics Performance Index and Its Indicators*. The World Bank. Washington, D.C.

126 Hasse, K. *Non-tariff barriers choke African trade.* Good Governance Africa. Available: http://gga.org/analysis/non-tariff-barriers-choke-african-trade

127 Barloworld Logistics. 2013. *2013* supply*chain*foresight*: serial innovation, smart partnerships and sustainable advantages.*

128 Surveys were conducted at the Annual SAPICS conference (Association for Operations Management in Southern Africa). The methodology used was convenience sampling.

KEY SKILLS AREAS

The respondents were asked to rate the importance of each of six skills groups, as shown in **Table 8**. *General management* is, for example, the ability to plan, organise and control; *Behavioural/Interpersonal skills* are aspects such as time and diversity management, people and social skills; *Logistics awareness* addresses issues such as seeing the 'big picture' and understanding the total cost concept; *Logistics analytical* focuses on key logistics elements such as demand forecasting, transport and warehouse management and quantitative analysis; *Logistics IT* considers software knowledge and computer skills; and *Environmental awareness* describes activities such as reverse and green logistics.

Table 8: Skills group rankings (2012 and 2011)

RANK	SKILLS GROUP RANKING IN 2012	SKILLS GROUP RANKING IN 2011
1	Logistics awareness	Logistics awareness
2	General management	General management
3	Logistics analytical	Behavioural/Interpersonal skills
4	Behavioural/Interpersonal skills	Logistics analytical
5	Logistics IT	Logistics IT
6	Environmental awareness	Environmental awareness

Logistics awareness is rated as the most important skills group in both years, followed closely by *General management*. The 2012 survey results show that *Logistics analytical* skills have moved from fourth to third position, indicating the increasing importance of these.

The survey also tested the skills that managers regard as critical when recruiting employees. The ranking of the skills over the two survey years was consolidated according to perceived importance, establishing the top 10 skills required by employers as listed in **Table 9**.

Table 9: Top 10 specific skills required by employers

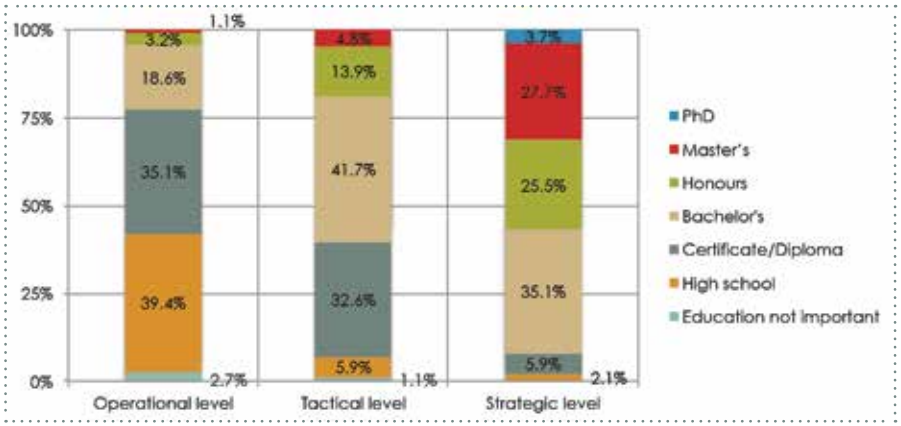
Specific skills area
Customer focus
Ability to plan and prioritise
Business ethics
Ability to see big picture
Team work
Problem solving
Ability to think outside the box
Communication skills
Business process improvement
Decision-making

The most important logistics and supply chain-related skills are *Customer focus* followed closely by *Ability to plan and prioritise* and *Business ethics*. The top 10 highest ranking skills comprise mostly 'softer' (i.e. *Business/Interpersonal skills* = 5) and 'broad' management skills (i.e. *General management* = 3). *Customer focus* and the *Ability to see the big picture* are the two most important *Logistics awareness* skills that are viewed as essential by the respondents.

EDUCATION AND EXPERIENCE REQUIREMENTS

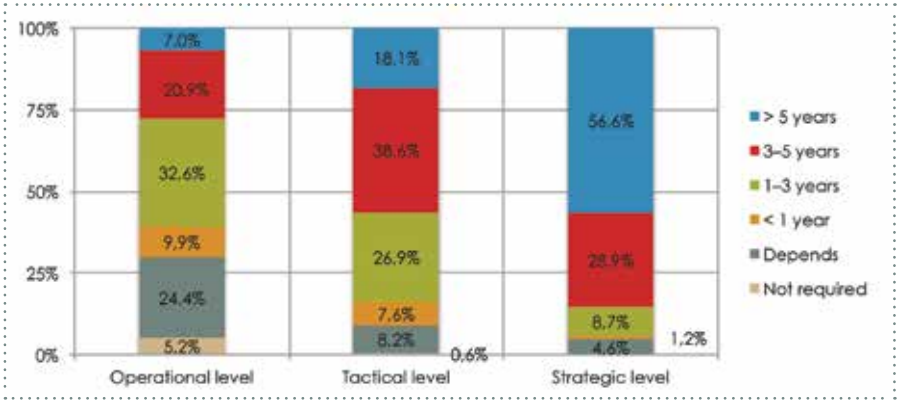
Employers indicate clearly that education is critical at all levels in the supply chain, with only a tiny proportion indicating that education is not important on an operational and tactical level. On operational level, South African businesses generally expect at least a high school education, if not more. At tactical level, businesses generally expect some form of tertiary education and at strategic level, this increases to a general minimum of a Bachelor's degree (see **Figure 38**).

Figure 38: Level of education required



Similar patterns are indicated regarding experience and generally it is expected that some level of experience is required, even at operational level. This increases at tactical level and even more at strategic level, where the majority of businesses require at least five years of experience (**Figure 39**).

Figure 39: Years of experience required



SKILLS SHORTAGES

South African employers have indicated that, although operational positions are relatively easy to fill (63% average over both years), an average of 65% indicated that it was difficult to fill tactical-level positions. Strategic-level positions are becoming more challenging to fill, with 63% indicating difficulties in 2011 and 66% in 2012 (see **Figure 40**).

Figure 40: Difficulty of filling positions at varying employment levels

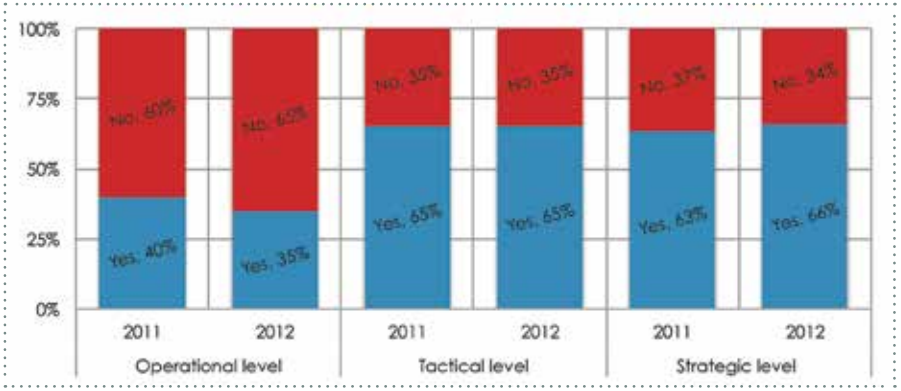


Table 10 ranks the positions that respondents indicated were most difficult to fill over the two-year period.

Table 10: Most difficult positions to fill

Operational level	Tactical level	Strategic level
Managers (incl distribution, operations, logistics, commercial)	Managers (incl inventory, project, operations, logistics, transport, warehouse)	General managers
Controllers and supervisors	Planners (incl transport, supply)	Supply chain managers
Truck drivers	Demand planners	Executives and directors
Demand planners	Business analysts	Planners
Clerks	Procurement staff	Supply chain strategists/ consultants
Supply chain IT specialists	Planners (inventory and production)	Business analysts/researchers
Procurement staff	Controllers and supervisors	Logistics managers
Stores/Warehouse staff	Supply chain strategists	Procurement managers
Logistics staff	Consultants	Operational managers
Buyers	Supply chain IT specialists	Specialist managers

CONCLUSION

This study provides a strong indication of the skills required in South African supply chains. The results imply that significant skills shortages exist in the supply chain industry in South Africa and that urgent interventions are required to attract and retain the skills needed to operate efficient, effective and competitive supply chains. These severe skills shortages have a significant impact on the competitiveness of South African supply chains and the ability to develop commerce with our major trading partners. Studies need to be conducted into the extent to which the skills shortages impact the country's competitiveness and its economic growth and development. Understanding the real impact of the skills shortages on the economy could provide the impetus to implement the interventions the country requires to address these critical skills shortages.

Profile of IMPERIAL Logistics

Driving client competitiveness

With extensive operations throughout Europe and Africa, IMPERIAL Logistics is uniquely placed to partner companies in leveraging the value inherent in their supply chains. By positioning ourselves as an extension of our clients' business - building our clients' brands alongside our own – we are co-collaborators in unlocking the competitive advantage contained in complex and dynamic logistics environments.

Our own differentiators lie in a combination of an extensive resource base of transportation, warehousing and distribution operations and best-of-breed integrative process and technology solutions. We apply our pre-eminent supply chain management skills to manage operational processes across end-to-end value chains on behalf of our clients. As a multi-branded business, we are in a position to optimise the benefits, scale and synergies that are derived from large businesses, while retaining agility, customer focus and an entrepreneurial flair that characterises smaller businesses. We recognise that our clients' requirements are unique and customise our service offerings accordingly, whilst leveraging our experience to benefit each client.

In turbulent economic times – and in the face of growing complexity and risk – leading companies need sustainable, resilient supply chains that support profitability and drive industry leadership. By anticipating these dynamics rather than simply reacting to them, IMPERIAL Logistics enables our clients' businesses to grow in an efficient, proactive and cost-effective manner. Ultimately, our reason for being is to contribute towards our clients' revenue, their bottom-line and their return on investments.

For further information, please visit

www.imperiallogistics.co.za

IMPERIAL LOGISTICS

Profile of Stellenbosch University: Centre for Supply Chain Management

The Centre for Supply Chain Management (CSCM) is an academic, consultative research centre within the Department of Logistics at Stellenbosch University. It creates value for global and local organisations and businesses.

The Centre facilitates a symbiotic relationship between the academic development of supply chain management theory and the practical application of the theory. It provides clients and the community with cost-effective research solutions in the field, while at the same time producing results that are publishable and contribute to the discipline. The CSCM team (core staff and a complement of associates) has provided successful consulting interventions to a number of leading South African and multinational companies and provides continuous strategic guidance to various small and medium-sized clients.

The core competencies provided are in the field of supply chain strategy, business strategy and positioning, market and economic research, freight flow modelling and transportation planning.

For more information on our services, contact:

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Department of Logistics
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Email: janh@sun.ac.za

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Profile of the Council for Scientific and Industrial Research (CSIR)

Through directed research, development and innovation, the CSIR improves the competitiveness of industry and the quality of life of the people of the country. South Africa's CSIR was established in 1945 as a science council by an Act of Parliament. It has a proud track record of multidisciplinary research and a bright and challenging future through science, engineering and technology (SET), undertaken by its innovative individuals and teams.

Specific areas of focus for the CSIR are the built environment, health, energy, the natural environment, defence and security, information and communications technology as well as the needs of industry. These areas are underpinned by key enabling technologies such as photonics, robotics, materials sciences, optronics and biotechnology, as well as leading scientific infrastructure.

The CSIR's main campus is in Pretoria while the organisation has regional offices in proximity to applicable industries in other provinces of South Africa. The CSIR generates knowledge and research outputs to be applied or transferred as proven technologies through skilled people and projects that add commercial and social benefit. The CSIR has a staff complement of about 2 400, of which close to two-thirds make up the science, engineering and technology (SET) expertise base.

CSIR Built Environment

As an operating unit of the CSIR, CSIR Built Environment creates innovative, cost-effective, sustainable solutions for uniquely South African and other global built environments. The unit's SET base is at the core of its multidisciplinary capabilities to deliver sustainable infrastructure development, asset preservation, socio-economic growth and global competitiveness in and for the built environment.

Environmentally sustainable and efficiently operated socio-economic infrastructure is critically important for the development and well-being of our country. The fundamental need for social development can be addressed only when people have access to basic amenities such as electricity, water and sanitation, as well as housing, schools and hospitals.

The impact of our track record resonates in energy-efficient buildings and sustainable human settlements, where the quality of life continues to improve. Social facilities, municipal infrastructure, transport and logistics networks, as well as coastal and port developments are benefitting from more effective systems and greater efficiency in service delivery.

Core focus

Within its mandate, the core focus of CSIR Built Environment is to:

- support the maintenance, upgrading and management of the country's transport, water and sanitation infrastructure and coastal and port developments
- support service delivery in the built environment
- assist city regions to plan and implement policy within the built environment
- create well-functioning, sustainable settlements and safer communities.

Competences at a glance

CSIR Built Environment is structured into six competence areas to deliver sustainable infrastructure development, asset preservation, socio-economic growth and global competitiveness in and for South Africa's built environment. The areas and their research capabilities are:

Transport Systems and Operations

- Logistics system analysis and supply chain engineering
- Transport economics
- Transport infrastructure management systems
- Public transport systems design

Transport Infrastructure Engineering

- Road engineering and materials
- Infrastructure engineering

Hydraulic Infrastructure Engineering

- Coastal engineering and ports
- Water supply and wastewater treatment infrastructure

Spatial Planning and Systems

- Urban dynamics modelling and integrated planning
- Human settlement design, geographic information systems and remote sensing analysis
- Decision-support systems

Building Science and Technology

- Building materials
- Construction industry innovation
- Public facilities (schools and hospitals)
- Low-income housing

Agrément South Africa

- The certification agency for the approval of innovative and new construction products, processes and solutions

Contact details

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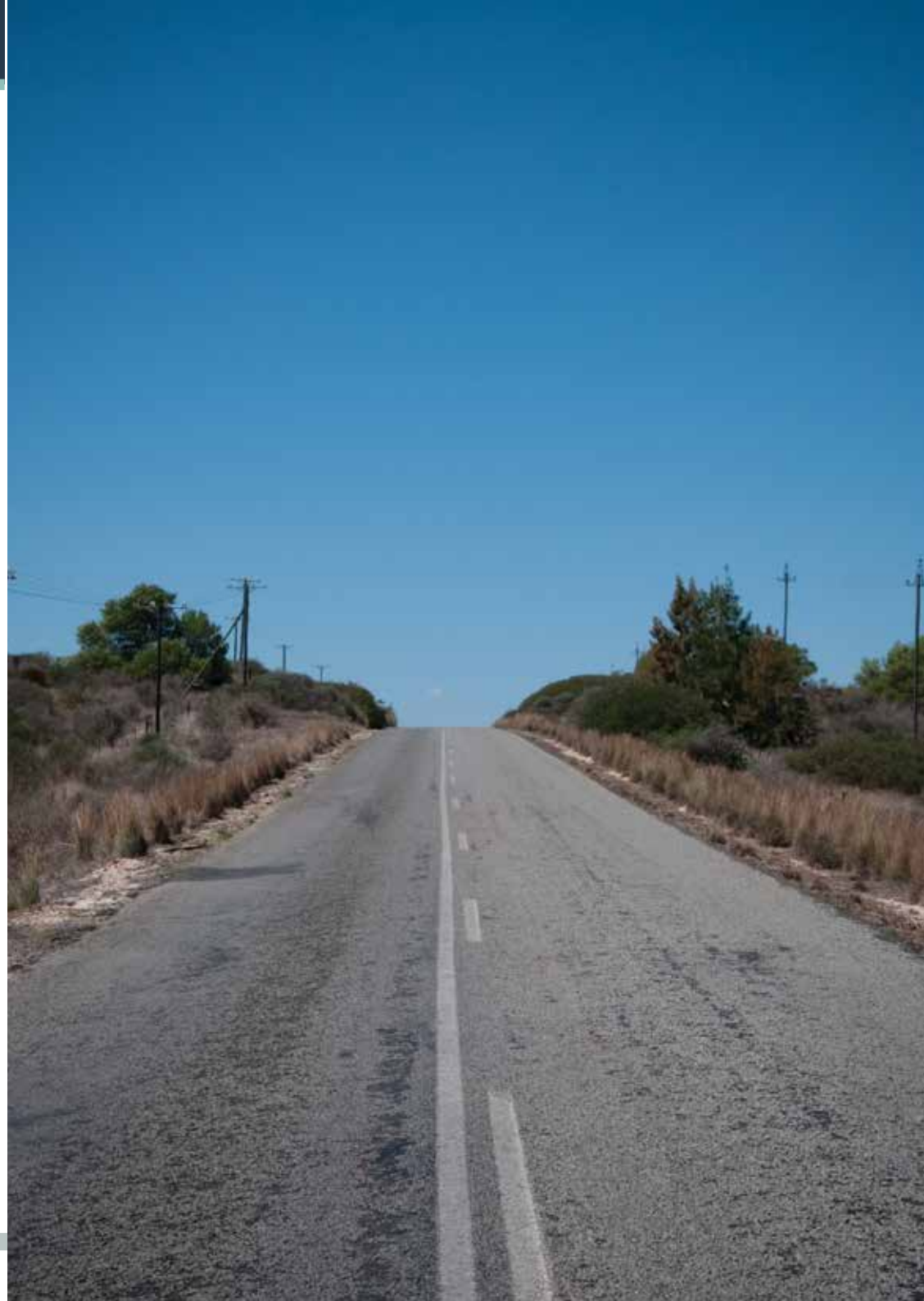

Notes

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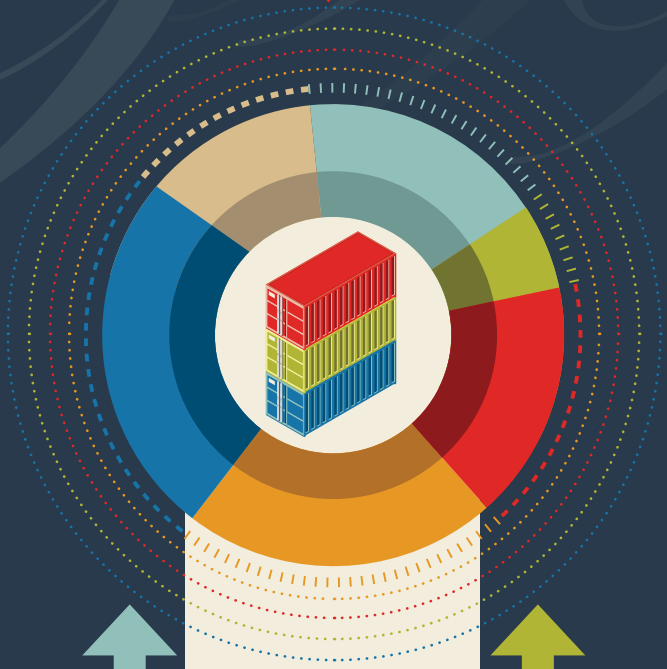
State of Logistics™ Surveys

Since the publication of the 1st State of Logistics™ survey in 2004, this document has become one of the premier references for logistics and supply chain practitioners in South Africa. The surveys all follow a similar format and thus allow for comparisons in quantitative trends over the years. These trends, together with essential research articles on issues and developments in the industry, are vital for keeping track with the state of logistics in South Africa.

We believe the survey provides the opportunity for government and private sector role-players to engage in discussions, interactions and dialogue on various supply chain and logistics issues and through these discussions, enable the industry to improve even more for the greater good of South Africa.



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IMPERIAL LOGISTICS

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